HERPETOLOGICA

Established 1936. Organ of the HERPETOLOGISTS LEAGUE,
A.A.A.S. Associate. Society of Systematic Zoology, Affiliate.
President, Dr. Hobart M. Smith. Vice-President, Dr. Angus M. Woodbury.
Secretary-Treasurer and Publisher, Chapman Grant,
Route 1, Box 80, Escondido, California

Officers elected and policies determined by vote of members. $4.00 per volume

Vol. 11 November 30, 1955 Final

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Observations on *Eumeces s. septentrionalis* in Kansas

By ROBERT CLARKE

To date there have been few published accounts, specific for Kansas, on the natural history of the black-banded, or prairie, skink, *Eumeces s. septentrionalis* (Baird). The secretiveness and spotty distribution of this lizard account in large measure for the dearth of such reports. It is the purpose of this paper to summarize certain published data and to present original observations in the hope that these findings will benefit future investigators.

The range of the prairie skink extends from southern Manitoba south to south-central Texas. Three forms are now recognized: *E. s. septentrionalis*, ranging from Manitoba south to southern Kansas (Smith, 1946) and western Missouri (Anderson, 1950); *E. s. obtusirostris* Bocourt, occurring from south-central Kansas to southern central Texas (Smith, 1946); and the recently described *E. s. pallidus* Smith and Slater, the range of which is a narrow strip bordering the western edge of *obtusirostris* in Texas (Smith and Slater, 1949). Specific distribution records of *E. s. septentrionalis* in Kansas are given by Burt (1928), Breukelman and Smith (1946), Breukelman and Clarke (1951), Taylor (1936), and Smith (1950). The range of the typical form in Kansas is the northeastern third of the state.

In Minnesota, Breckenridge (1943) has found the habitat preference to be less dense soils, where most of the time is spent beneath sticks, stones, bark, boards, or pieces of tin or paper, in small excavations. The articles of cover selected are usually settled well into the surface of the sod. In Iowa, Ruthven (1910) states: "It is found in the uplands and in the higher meadows, but only rarely . . . Its principal habitat is undoubtedly the upland prairie." The Texas forms frequent the vicinity of larg masses of *Opuntia*, where the lizards take refuge near the bases of the cactus (Taylor, 1936), and they have been taken from beneath piles of lumber, fallen bark, large flat rocks, logs, and the like in both wet and dry situations (Brown, 1950). The Kansas habitat has been described by Smith (1950) as ". . . open grassy hillsides provided with small flat rocks. Very spotty." Burt (1928) has reported such diverse situations as: a dooryard in grass, under stones in a dry creek bed, along a timbered creek under stones, at the foot of a stony hill, at the side of a narrow

piece of bottomland, upland edge of a cornfield, and moist grassland and woods. It has been reported that the skinks may utilize cover near human habitations (Smith, 1946).

The present paper covers observations in three Kansas counties: Osage, Lyon, and Chase, which lie adjacent in a northeast-southwest direction in east-central Kansas. The topography consists of hilly eastern Osage, with its wooded, rocky ledges; the cultivated flood plains of the Cottonwood and Neosho Rivers in Lyon; and the rolling Flint Hills prairie of Chase. There are extensive areas of native prairie in all three counties.

The prairie skink has been taken in several distinctly different types of habitat. In Osage County, two were found in a rather open, grassy field near a small stream. One, a juvenile, was in the open, moving about in the grass among rocks. An adult female was collected under a nearby stone. This area is largely pasture with scattered trees and a number of exposed rocks along the stream. On Chicken Creek, just east of U. S. Highway 75, four gravid females were taken along two hundred yards of the creek bank on June 8, 1950. Two of these were discovered together beneath a large flat rock six feet from the edge of the creek and two feet above it. At the time the ground was moist, but not muddy. Cultivated fields extend to a point where the sloping bank of the creek begins. The bank consists of dirt and gravel, with larger stones scattered about. The side of the creek where the lizards were taken is open, with only a few willows and weeds present, whereas the opposite bank is quite heavily wooded. The other two lizards were found about eight feet apart under flat stones in a shaded section some two hundred yards downstream. These were also close to the creek edge but on slightly higher ground. Although both of these locations showed signs of having been flooded repeatedly, these lizards were not transients, for they had excavated extensive tunnels beneath the rocks under which they were found.

An urban colony of skinks has been found in Lyon County. The location is near mid-town of Emporia at the crossing of the Santa Fe Railroad tracks by Constitution Street. There are several vacant lots on either side of the railroad right-of-way, but this is a residential and business district with considerable traffic. Adjoining the railroad bed on the north side is a long pile of large rocks and broken concrete which should provide suitable cover; however, the lizards were taken on the south side of the tracks in slightly rocky ground, being dug out when the earth was removed for sidewalk construction. One young adult was found one-half mile west of this location on July 10, 1950, beneath a small stone near a temporary rain pond in an open, grassy situation.

The Chase County specimens taken have been found in the typical Flint Hills habitat, an area of rolling, grass-covered, prairie hills. There are many ravines with abundant rocky outcroppings. Occasionally, trees and bushes grow along the small streams which flow through these ravines. The skinks have been found under flat rocks only along those ravines that have trees, although they were not among the trees, but above them on the grassy hillside.

The hibernating sites of most reptiles and amphibians are but little known. This is especially true of the prairie skink. Specimens have been collected at a depth of three feet in a gravel bank along a stream in

Minnesota (Breckenridge, 1943) and fifty-two individuals were unearthed from a gravel deposit at a depth of four and one-half feet in Iowa (Scott and Sheldahl, 1937). An apparent hibernation site was discovered in Emporia, Kansas, on March 31, 1950, at the aforementioned railroad crossing. The workmen excavating for the sidewalk construction unearthed two skinks and seventeen lined snakes, *Tropidoclonion lineatum* (Hallowell). On April 12, four additional lined snakes were found; the following day three skinks were taken. Two more skinks were dug out on April 18, making a total of seven *Eumeces* and twenty-one *Tropidoclonion* which were discovered. All of the reptiles were found within a small area four feet wide by twelve feet in length. The ground at this point is slightly rocky, but not gravel as are the other reported hibernation sites.

The only available published account of the eggs of the prairie skink is the Minnesota report of Breckenridge (1943). Five captured females laid thirty-six eggs between June 25 and July 4. The extremes in width were 7 mm. and 9 mm.; the extremes in length, 12 mm. and 15 mm. The average size of these eggs was 8.0 mm. by 13.4 mm.

Four gravid females from Osage County, Kansas, were kept by the author in 1950. Between June 23 and June 27, the four females laid a total of thirty-two eggs. The number of eggs for each female was 10, 9, 7, and 6. Each normal egg was measured within a few hours of oviposition. Three of the eggs were malformed and were not measured. The following table gives the sizes to the nearest one-half millimeter.

Number of eggs	Size in mm.
2	6.5 x 11.0
1	7.0 x 10.5
1	7.0 x 11.0
4	7.0 x 11.5
6	7.0 x 12.0
1	7.0 x 12.5
2	7.5 x 12.0
4	7.5 x 12.5
2	7.5 x 13.0
1	8.0 x 12.0
2	8.0 x 12.5
3	8.0 x 13.0

The extremes were: width, 6.5 mm. and 8.0 mm.; length, 10.5 mm. and 13.0 mm. The average size was 7.3 mm. by 12.0 mm.

There is a discrepancy in the sizes of the Minnesota and Kansas measurements. This may be due to several factors, chief among which may have been a time lapse between oviposition and measurement by Breckenridge. Since these eggs absorb moisture, this fact may account in part for the size difference. The fact that the females were all observed under captive conditions may have been influential. More data are needed, particularly field observations, before reliable conclusions can be reached regarding definite egg size at the time of deposition.

A young skink captured in Osage County, Kansas, on August 4, 1950, measured 32.5 mm. from snout to vent. On the basis of the average growth rate of 0.37 mm. per day and average size of hatchling at 25.5

mm. as found by Breckenridge (1943), the hatching date of this specimen was about July 16. Another small skink taken while hibernating measured 45.5 mm. from snout to vent. Assuming that this lizard entered hibernation early in October, it was probably hatched in late August or early September.

LITERATURE CITED

Anderson, Paul. 1950. A record for the northern prairie skink, *Eumeces s. septentrionalis* (Baird) in Missouri. Herpetologica, 6:53.

Breckenridge, W. J. 1943. The life history of the black-banded skink, *Eumeces s. septentrionalis* (Baird). Amer. Mid. Nat., 29: 591-606.

Breukelman, John and Hobart M. Smith. 1946. Selected records of reptiles and amphibians from Kansas. Publ. Univ. Kansas Mus. Nat. Hist. 1:101-112.

Breukelman, John and Robert F. Clarke. 1951. A revised list of amphibia and reptiles of Chase and Lyon Counties, Kansas. Trans. Kansas Acad. Sci., 54:542-545.

Brown, Bryce C. 1950. An annotated list of the reptiles and amphibians of Texas. Baylor Univ. Press, 257 pp.

Burt, Charles E. 1928. The lizards of Kansas. Trans. St. Louis Acad. Sci. 26:1-81.

Ruthven, Alexander G. 1910. Contributions to the herpetology of Iowa. Proc. Iowa Acad. Sci., 17:198-209.

Scott, T. G. and R. B. Sheldahl. 1937. Black-banded skink in Iowa. Copeia, 1937:192.

Smith, Hobart M. 1946. Handbook of lizards. Comstock Publ. Co., Ithaca, 557 pp.

1950. Handbook of amphibians and reptiles of Kansas. Univ. Kansas Mus. Nat. Hist., Misc. Publ., 2:1-336.

Smith, Hobart M., and J. A. Slater. 1949. Southern races of *Eumeces septentrionalis*. Trans. Kansas Acad. Sci., 52: 438-448.

Taylor, Edward H. 1936. A taxonomic study of the cosmopolitan scincoid lizards of the genus *Eumeces*. Univ. Kansas Sci. Bull., 23: 1-643.

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Effect of Preservatives upon Pattern in a Mexican Garter Snake

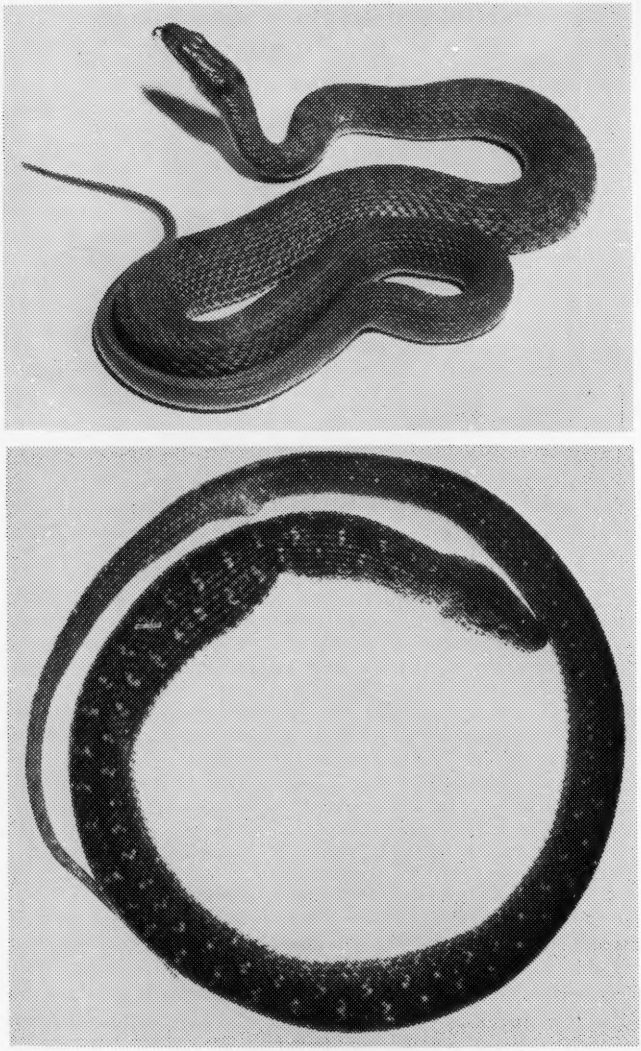
By HOBART M. SMITH

Two specimens of *Thamnophis rufipunctatus* (Cope) collected by Roger Conant on September 29, 1949, in a pile of rocks near the Río Nazas, in the vicinity of La Goma, Durango, Mexico, are of more than passing interest. I am much indebted to Mr. Conant for the gift of these specimens, and for a photograph, color notes, and certain other data incorporated herein. The snakes are both males, now Univ. Ill. Mus. Nat. Hist. Nos. 33956, 36129. Respectively, the scale rows are 21-21-17, 21-23-17; ventrals 165, 163; caudals ?, 77; supralabials 8-8, 9-10; infralabials 9-10, 10-11; preoculars 2-2, 2-2; postoculars 3-3, 3-4; supralabials entering eye, 4-4, 4-5+6; total length 570 mm., 415 mm.; tail length 87 mm.+, 101 mm. In these respects the specimens fall within the known range of variation in the species, although the occurrence of 23 scale rows and of two supralabials in contact with eye is a rarity among records at present available.

The pattern of these specimens in life was more or less typical of the species, consisting of dim dark spots upon a lighter background above on the body, more prominent in the smaller specimen, but dimly evident in the larger. Mrs. Isabelle Conant photographed both examples in life (see pl. 1 upper for the smaller specimen), and the salient colors were recorded in terms of Ridgway's Color Standards and Nomenclature. These are, respectively for the larger and the smaller, as follows: *dorsal ground color* Olive-Brown, Buffy Olive; *dorsal dark spots* Sayal Brown, Mikado Brown; *top of head* Olive-Brown, Buffy Olive; *dark marks on ventrum* Black; *vertical infralabial marks* Dark Gray; *gular region* Marguerite Yellow in both; *center of belly* Reed Yellow, Primrose Yellow; *underside of tail* Buffy Olive, Ecru-Olive; *tongue* mostly gray at base but with some pinkish and tip dark gray, base pinkish but heavily stippled with dark gray becoming solid gray toward tip; *pupil* black, edged with gold in both; *iris* reddish brown, dark orange-brown.

Five years of storage in alcohol have resulted in loss of the yellows and reds. Absence of apparently the latter creates a light-spotted pattern (see pl. 1 lower) quite unlike that of the live snake. No evidence of the dark spots as such remains. It is thought, however, that the fine dark edging of the light spots may represent the dark spots, for it appears that *each light spot actually occupies the center of a former dark spot.* There are three rows of light spots, as indeed there were in life of dark spots, the spots becoming smaller laterally, and those in the outer row being placed along the first and second scale rows. The spacing of the light spots is such as to render this correlation with the former dark spots a virtual certainty. It may thus be concluded that the pigment producing the effect of dark spots in life is an alcohol-soluble substance, the absence of which leaves a light-colored area. The pigment may be an erythrin, for the spots do appear reddish in life; it is in any event probably not melanin.

It is possible that the light spots appearing in preserved specimens



Pl. 1: Upper, *Thamnophis rufipunctatus,* Univ. Ill. Nat. Hist. No. 36129, La Goma, Durango, pattern in life (photo by Isabelle Hunt Conant). Lower, *Thamnophis rufipunctatus,* Univ. Ill. Nat. Hist. No. 36129, La Goma, Durango, pattern after five years of preservation (photo by Charles A. McLaughlin).

tend to diminish in size in larger examples, for they are smaller and less well defined, especially in the dorsal row, in the larger specimen.

The alteration of pattern by preservation in these specimens is of specific as well as general interest. The first name applied to this species, *Chilopoma rufipunctatum* Cope (Rep. Geogr. Geol. Expl. Surv. W. 100th Mer., vol. 5, Zool., 1875, p. 544) from "Southern Arizona," very likely was selected in reference to light spots such as those exhibited in the present preserved specimens. Since the light spots are not evident in life, and are not mentioned in most descriptions of the species, the reference of a specimen showing such spots to a dark-spotted species has been open to question. The type of *C. rufipunctatum* is a very small individual described as having "six rows of small alternating bright rufous or orange spots, each of which occupies one, and sometimes an adjoining scale. They stand on the first and second, the fifth, and on the eighth rows, respectively. On the posterior third of the length they are wanting, and are indistinct posterior to the middle of the length." (Cope, Ann. Rep. U. S. Nat. Mus. 1898, p. 1090.) This description readily may be interpreted as applicable in detail to alcohol-preserved examples such as the present two; the spots are somewhat smaller, and they are not "bright rufous or orange" in our specimens, but otherwise the description is wholly appropriate for them. The size of spots is presumably subject to variation, and it is to be presumed that Cope assumed the color of the light spots to be bright red in life, since in comparison with the markings of other herps in preservative they have the appearance of faded light spots, certainly not of dark spots. Thus one of the most questionable features in application of the name *rufipunctatum* to this species is eliminated.

Although the role of the preservative in producing pattern variants has not previously been pointed out for this species, the occurrence of the two types of patterns (light-spotted and dark-spotted) has been noted at least by Cope (Ann. Rep. U.S. Nat. Mus., 1898, p. 1088) in a series of *"Eutaenia multimaculata"* from Chihuahua. Elsewhere the dual pattern has been overlooked.

Application of the name *Thamnophis angustirostris* (Kennicott, 1860) to this species is most unfortunate. The type is said to have come from a locality (Parras, Coahuila) distant from the known range of the species (Arizona and southwestern New Mexico to Durango) both ecologically and geographically. Since the type is also markedly different in character, there is little reason, other than custom, for application of its name to the present species, properly known as *Thamnophis rufipunctatus*. My original suggestion that the type of *angustirostris* be considered a hybrid between *rufipunctatus* and *melanogaster* requires assumption that both species occur in habitats to which neither is adapted and in an area clearly outside the known range of either (if indeed the type is from the immediate environs of Parras).

On the other hand it is possible that the type came from the plateau near Parras, only about 20 miles away and where habitats occur that reasonably could satisfy the requirements of both *melanogaster* and *rufipunctatus*. However, the nearest actual locality of record for either species is in southwestern Durango, some 250 miles away (both re-

corded there) and in southern San Luis Potosí, some 225 miles distant (*melanogaster* only).

The interpretation of the type of *angustirostris* as a hybrid between *melanogaster* and *rufipunctatus* is thus questionable on both geographic and ecologic bases. It is also questionable on morphologic grounds. It is true that no character unknown (or at least unexpected) in either *melanogaster* or *rufipunctatus* is at present known to exist in the type of *angustirostris*. With *rufipunctatus* it shares (1) a distinctly spotted pattern (present in juvenile *rufipunctatus,* occasional in *melanogaster*); (2) a fairly strong barring on the labials (not so strong in *melanogaster*); and (3) 21-21-17 scale rows (never more than 19-19-17 in *melanogaster*). With *melanogaster* it shares (1) a nearly completely black belly (never even approached in *rufipunctatus*); (2) a single preocular (never in *rufipunctatus*); (3) two labials entering orbit (rare in *rufipunctatus*); (4) no markings on head except for the labia (*rufipunctatus* has irregular markings on the head in juveniles); and (5) 149 ventrals (152 minimum known in *rufipunctatus* females, although the full range of variation undoubtedly would embrace 149).

A comparison of the characters shared with *rufipunctatus* and with *melanogaster* reveals a markedly greater similarity to the latter. Yet the type of *angustirostris* does not fit into the picture of geographic variation in *melanogaster*. The two black-bellied subspecies occur near the southern edge of the central Mexican plateau, whereas the subspecies of the western and northern parts of the plateau (Durango, San Luis Potosí, Guanajuato, Michoacán, Jalisco) have relatively little belly pigment (approximately the same as in *rufipunctatus*). Therefore, it seems unlikely that hybrids between northern examples of *melanogaster* and southern *rufipunctatus* would be black-bellied.

Granting that much more information is needed for conclusiveness, present knowledge suggests, as the strongest probability, that *angustirostris* is a subspecies of, or a distinct species fairly closely related to, *melanogaster*. Field work in the vicinity of the type locality at Parras, Coahuila, should unquestionably "produce results" at least so far as the status of this enigmatical form is concerned.

Conclusions. In at least one case a pattern of dark spots is known to be alterable to a somewhat different pattern of light spots through the effect of preservatives.

The type of *Chilopoma (Thamnophis) rufipunctatum* is a juvenile whose pattern apparently was altered in the above manner by preservative; the type is thus not exceptional in this regard among other examples of the species.

The proper name for the species of *Thamnophis* in Arizona and northwestern Mexico sometimes referred to as *T. angustirostris* is *T. rufipunctatus,* of which *T. multimaculatus* is a synonym.

T. angustirostris is a form of northern central Mexico known only from the type, related specifically or subspecifically to *T. melanogaster*. The type cannot reasonably be interpreted at the present time as a hybrid between *T. rufipunctatus* and *T. melanogaster*.

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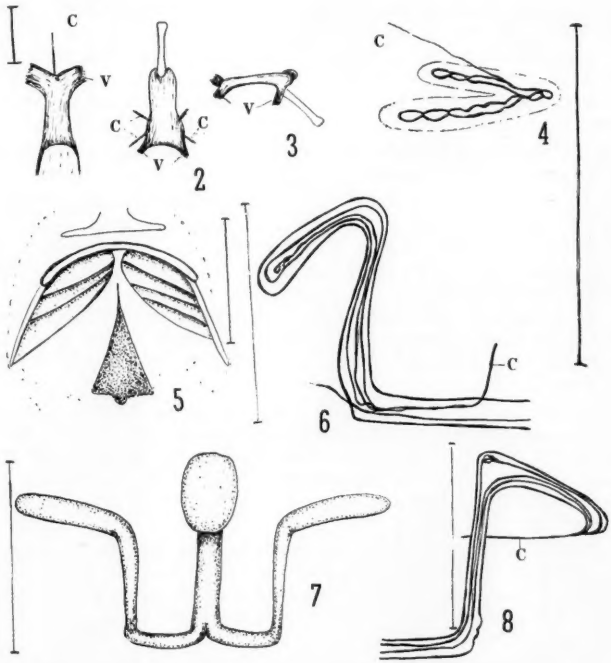
Brain Chorioid Plexuses of Reptiles

By WILLIAM A. HILTON

It is rather remarkable that so little is known about the brain plexuses of reptiles. It is easy to understand why this is so with lizards and snakes, for in them the structures are often obscure, but in the other reptilian groups the plexuses are especially well developed.



The scale near the figures equals 1 mm. In most cases the cephalic end is towards the top of the page. It is to the right in Figs. 3, 4, and 14. C—arterial branch; V—vein. 1, 2 and 3. Top, bottom and side views of the roof of the fourth ventricle of *Anniella*. 4. Lateral plexus of *Anniella*. 5. Underside of the fourth ventricle roof of *Sceloporus*. 6. One lateral filament of the cerebral hemisphere of *Sceloporus*. 7. *Sceloporus* epiphysis connected with the third ventricle plexus and the lateral cerebral plexuses. 8. One lateral cerebral filament of *Sceloporus* showing a small artery entering its tip.

In general papers on the central nervous systems of reptiles, such as Meyer (1892), Herrick (1910), Lange (1911) and others, there is little reference to the plexuses of the brain. With lizards and snakes, there is the barest mention of these brain parts; Hines (1923) and Cairney (1926) give nothing of them. Stieda (1875), Humphrey (1894), Gage (1895) and Bailey (1916) have come in contact with them in turtles. Gage is the clearest in describing position and form and Bailey discusses the early origin of the lateral plexuses, from the anterior area of the roof plate, between the paraphysis and taenia fornicis.

Herrick (1890) and Crosby (1917), in their studies of the alligator brain, give nothing on the plexuses. Pettit and Girard (1902) mention the villous character of the lateral plexuses.

In 1953, I gave an account of the lateral and third ventricle plexuses in salamanders, and of the fourth ventricle in 1954. The plexuses of elasmobranchs, of frogs and toads, and of the cyclostomes, were separately considered (Hilton, 1954). Other papers are in press or in preparation.

Lizards and snakes have the simplest of reptile brain plexuses, especially in the cerebral region.

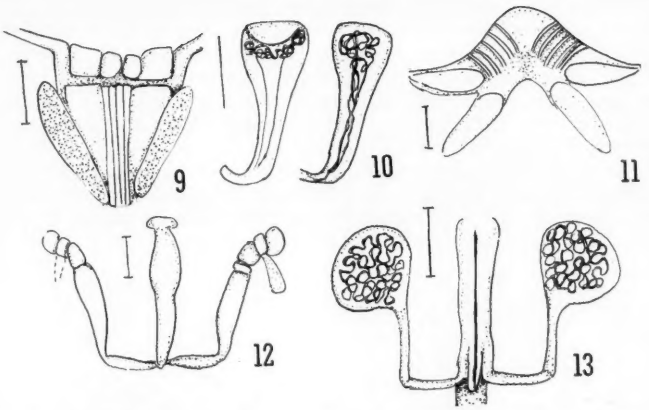
In *Crotaphytus,* the actual roof of the fourth ventricle is rather restricted, but it and the surrounding membrane are quite vascular. An inside view is shown in Fig. 15. In another smaller specimen of *Crotaphytus,* the central part of the fourth ventricle plexus shows a number of ridges and thickenings.

In *Sceloporus,* the central part of the membrane of the fourth ventricle roof is strengthened by five or six thickened, slightly overlapping stiff connective tissue plates (Fig. 5). A highly vascular area is ventral to this.

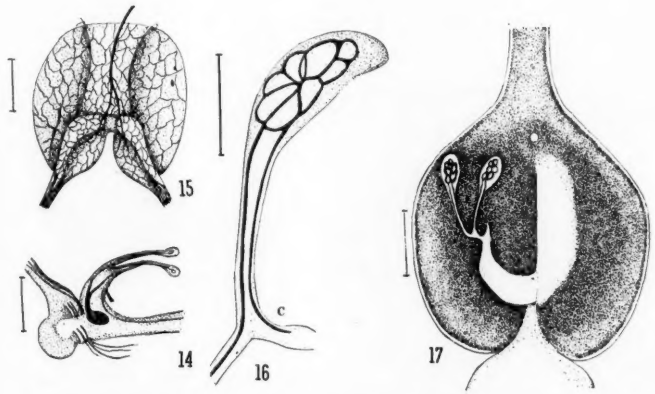
In the limbless lizard *Anniella,* the roof of the fourth ventricle appears as a blood sinus, with small arteries entering the cephalic end and the sides, and a pair of large veins draining the cephalic and caudal areas (Figs. 1, 2, 3). In *Phrynosoma,* besides lateral thickenings in the roof of the fourth ventricle, there are five ridges on each side of the center (Fig. 11).

The third ventricle plexus is continuous with the general region of the epiphysis or pineal region. From here it extends down and is connected with the small plexus of a lateral ventricle on each side. This is shown in *Sceloporus* (Fig. 7), *Crotaphytus* (Figs. 13, 14, 17), and in *Phrynosoma* (Fig. 12).

In *Crotaphytus,* these lateral plexuses are very simple and small, consisting of a single extension with a knot of capillaries in the enlarged end (Figs. 13, 14, 16, 17). They differ often on different sides of the same brain (Fig. 10). Sometimes these lateral processes are bent as in *Sceloporus* (Figs. 6, 7, 8), *Phrynosoma* (Fig. 12), and *Crotaphytus* (Fig. 13). The blood vessels in these simple processes may be simple loops (Figs. 6, 8), or they may have a capillary network at their slightly expanded ends (Figs. 13, 16, 17). The blood supply may be entirely along the stem from the base (Fig. 16), where an artery and a vein may be seen in the stalk, or small arteries may penetrate the slender processes at their ends (Fig. 8), or along the sides (Fig. 6).



9. Under side of the roof of the fourth ventricle of a large *Crotaphytus.* 10. Lateral cerebral extensions of the chorioid plexus in each of the cerebral hemispheres without their connections, *Gerrhonotus.* 11. Roof of the fourth ventricle of *Phrynosoma,* from below. 12. Central and lateral chorioid plexuses of *Phrynosoma.* 13. Third and lateral cerebral plexuses from a small *Crotaphytus.*

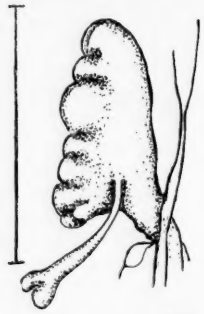


14. Lateral view of the cerebral plexuses of the lateral ventricles connected with the pineal region, ventral side up, *Crotaphytus.* 15. Under side of the fourth ventricle roof and adjacent parts of *Crotaphytus.* 16. A single cerebral extension of one side of the last, enlarged. 17. Inside of the dura with attached pineal region and lateral plexuses of the cerebral hemispheres attached, *Crotaphytus.*

The cerebral plexuses of *Anniella* are very small and simple, consisting of two lobes extending caudally from a short common stem. Externally a delicate arteriole was seen running to the simple plexus (Fig. 4).

In *Ophisaurus,* the roof of the fourth ventricle was not unlike that of some amphibians, V-shaped with ventral ridges (Fig. 21). In this same form the lateral plexuses were each simply lobed and at the ends of long, slender stalks (Fig. 20).

In the snakes studied, the fourth ventricle and lateral plexuses were similar to those of lizards, but a little better developed. In *Thamnophis,* the lateral plexuses were more lobed than the last, with one small division extending off from the main mass (Figs. 19, 20).



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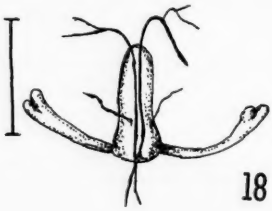

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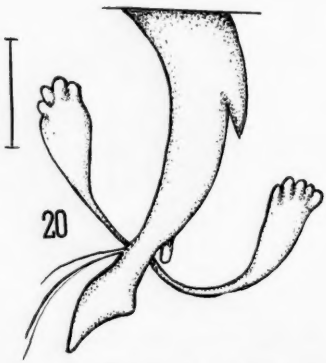

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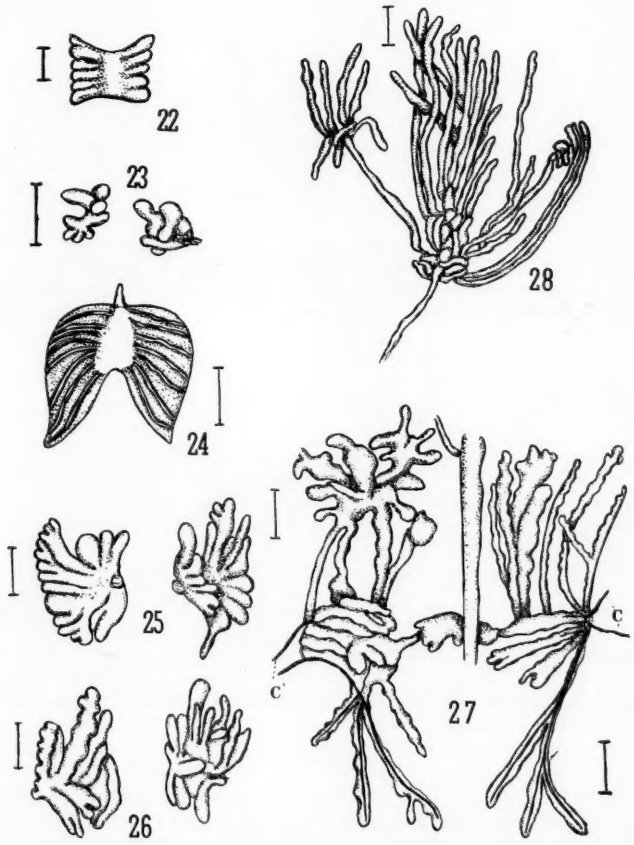
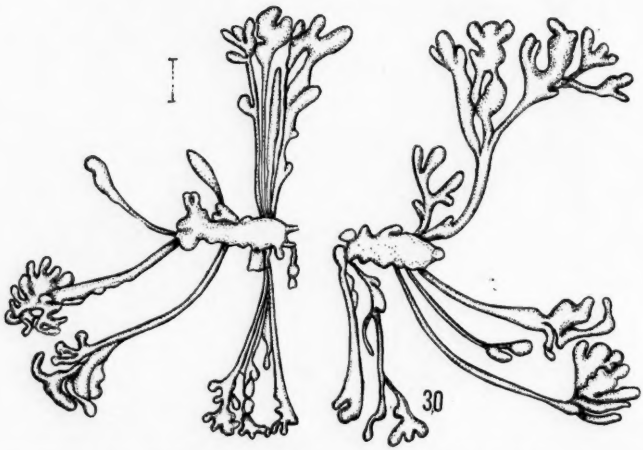
18. Ventral view of the third ventricle plexus attached to the lateral plexuses of *Thamnophis.* 19. Side view of one of the lateral plexuses of the last. 20. Side view of the third ventricle plexus with the attached lateral plexuses of *Ophisaurus.* 21. Ventral view of the roof of the fourth ventricle of the last.



22. Ventral view of the fourth ventricle roof of *Chrysemys* with a shell length of 9 mm. 23. Lateral plexuses of the last. 24. Ventral view of the underside of the roof of the fourth ventricle of *Chrysemys* with a shell length of 30 mm. 25 and 26. Views of the lateral plexuses of the last. 27. Both lateral plexuses and their central connection of an adult *Chrysemys,* viewed from above. 28. Single lateral plexus from an adult *Chrysemys.*

29



30

29. Under view of the roof of the fourth ventricle of an 18-inch alligator.
30. Lateral plexuses of the last.

In a turtle *(Chrysemys)* of 9 mm. shell length, the roof of the fourth ventricle has about five folds or thickenings on each side (Fig. 22). At this stage the lateral plexuses possess several irregular lobes. In a turtle of 30 mm. shell length, the roof of the fourth ventricle is ridged below (Fig. 24). In later stages the ridges become more prominent and the median cephalic extension becomes longer and the cephalic lateral plexuses have more and longer lobes (Figs. 25, 26). In the adult turtle the lobes of the lateral plexuses have grown out into complex filamentous masses on each side with the majority of the filaments directed cephalad. Fig. 27 shows the complete plexus with arteries on each side supplying the filaments. Veins run out the common stalk. The plexus of one side of another specimen is shown in Fig. 28.

The roof of the fourth ventricle in the alligator has two long, forward extensions with many lateral points on its inner lateral surfaces (Fig. 29). The plexuses of the lateral ventricles are made up of irregular filamentous lobed bodies; one main division extends forward, two laterally and one or two ventrally and in addition there are some smaller filaments (Fig. 30).

SUMMARY

1. Lizards and snakes have a much simpler system of brain plexuses than the turtle or the alligator.

2. In lizards and snakes the roof of the fourth ventricle is reduced, but the area some distance about may be quite vascular.

3. In all lizards studied the lateral plexus was much reduced, usually a simple straight or much bent single extension from the third ventricle extension from the epiphysis.

4. The fourth ventricle plexus of *Anniella* was like a small blood sinus with small arteries supplying it and a pair of large veins leaving. The lateral plexus on each side was very small, with two small lobes from a cephalic main part.

5. Small arteries supply the roof of the fourth ventricle in lizards at least and veins at the extremities drain the blood away. Sometimes both arteries and veins run in the same stalk in the lateral plexuses when they are simple.

6. In turtles and the alligator the roof of the fourth ventricle is well developed, not unlike some amphibians.

7. The lateral plexuses of turtles and alligator are very extensive and much divided into many lobes or villi.

LITERATURE CITED

Bailey, P. 1916. The morphology and morphogenesis of the choroid plexus with especial reference to the development of the lateral telencephalic plexus in Chrysemys marginatus. Jour. Comp. Neur., 2:507-531.

Cairney, J. 1926. The forebrain of Sphenodon. Jour. Comp. Neur., 42:255-348.

Crosby, E. C. 1917. The forebrain of the Alligator. Jour. Comp. Neur., 27:325-402.

Gage, S. P. 1895. Comparative morphology of the brain of the soft-shelled turtle (Amyda mutica) and the English sparrow. Trans. Amer. Micr. Soc., 17:185-238.

Herrick, C. L. 1890. The morphology of the forebrain of Amphibia and Reptilia. Jour. Comp. Neur., 20:413-447.

Hilton, W. A. 1953. The chorioid plexus of the fourth ventricle of salamanders. Anat. Rec., 115:121-126.

1953. The chorioid plexus of the lateral and third ventricles of tailed Amphibia. Jour. Comp. Neur., 99:545-560.

1954. The brain chorioid plexuses of elasmobranchs. Bull. S. Calif. Acad. Sci., 53:107-113.

1954. The chorioid plexuses of frogs and toads. Herpetologica, 10:111-114.

1954. The brain chorioid plexuses of cyclostomes. Trans. Amer. Micr. Soc., 73:410-412.

Hines, M. 1932. The development of the telencephalon in Sphenodon. Jour. Comp. Neur., 35:483.

Humphrey, O. D. 1894. On the brain of the snapping turtle (Chelydra serpentina). Jour. Comp. Neur., 4:73-116.

Lange, S. J. 1911. Das Vorderhirn der Reptilien. Folia Neurobiol., 5:548-597.

Meyer, A. 1892. Ueber das Vorderhirn einiger Reptilien. Zeit. f. wiss. Zool., 55:63-133.

Petit, A. and J. Girard. 1902. Sur la morphologie des plexus choroides du systeme nerveux central. Comp. Rend. Soc. Biol., 54:698.

Rabl-Ruckhard, H. 1878. Das Centralnervensystems des Alligator. Zeit. f. wiss. Zool., 30:356.

Stieda, L. 1875. Ueber den Bau des Centralnervensystems der Schildkrote. Zeit. f. wiss. Zool., 25:361-406.

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MATING AGGREGATIONS OF GARTER SNAKES.—Few observations of copulating masses of garter snakes have been published in recent years. Therefore, it seems worthwhile to place on record two observations of small bundles of snakes that were apparently attracted together for breeding purposes. Both involved the red, black, and green striped common garter snake, *Thamnophis sirtalis tetrataenia* Cope, and both occurred on open grassy slopes of the San Francisco Peninsula, San Mateo County, California, in bright sunlight on warm mornings.

The first observation was made on Oct. 25, 1946. The small writhing mass of brightly colored snakes began to break up as soon as approached. One large female and three smaller males were captured. At least three other small snakes, of a size characteristic of males of this species, escaped.

The second observation occurred on November 5, 1947. A similar indistinct ball of entwined snakes was unexpectedly encountered. Their immediate attempted escape did not allow for detailed observations. One large female and four smaller males were captured. If additional individuals were present, their escape was not observed.

Although actual copulation was not observed on these occasions, microscopical examination of smears from the caudal end of the oviducts of the females revealed the presence of large masses of spermatozoa. In both instances several males seemed to be attracted to a single female. It is of interest that during three years of intensive field study of garter snakes these observations of copulating "snake balls" occurred only in the fall, whereas a number of observations of apparent mating during March and April involved only pairs of snakes.—Wade Fox, Department of Anatomy, Louisiana State University School of Medicine, New Orleans.

Observations on the Herpetofauna of The Mexican State of Nayarit

By THOMAS H. LEWIS AND MURRAY L. JOHNSON

Nayarit is one of the newer Mexican states, having been known in colonial times as Nuevo Galicia, and up to 1917 as the Territory of Tepic. It is also one of the least explored states biologically, not the least of reasons being its extremely broken and difficult physiography, the forbidding mountains to the east only quite recently having been penetrated by a railroad and highway. The writers were able to spend a brief period in Nayarit near the end of the dry season of 1954, prior to the completion of the western highway between Nogales, Sonora, and Guadalajara, Ialisco. Studies of the mammals and birds will be reported elsewhere. The collections on which the present report is based were made under the auspices of the Puget Sound Museum of Natural History, College of Puget Sound, Tacoma, Washington. Specimens are referred to herein by the field numbers.

Nayarit is a roughly quadrangular land mass on the arid western coast of Mexico. Its mountainous eastern portions slope from the Sierra Madre Occidental into narrow strips of agricultural and grazing lands, deserts, and coastal mangrove swamps and palm-fig jungles. The Sierra de Nayarit in the south and east presents one of most imposing mountain regions of North America. Our studies began at the Río Acaponeta near the northern border, in an area transitional between Sinaloan thorn forest dominated by *Pachycereus*, and a thinner, lower scrub with emergent palmettoes instead of cacti. Continuing southward collections were made in the oak forest and grasslands around Tepic. To the west the country descended through rolling, dry, brush-covered hills and volcanic cones, dense cohune-amate forests, and mangroves. Our principal efforts were in these last areas. Color notes were made from living or freshly killed specimens. Notations on scutellation were included when reflecting differences from the type, or from the known characteristics of the population. Thanks are due to Mr. Bayard Brattstrom of the University of California at Los Angeles for his many helpfui suggestions during the examination of the material. We are especially indebted to Dr. Edward H. Taylor and Dr. Hobart M. Smith for the identification of puzzling specimens, and for their generous assistance in the preparation of the manuscript.

Microbatrachylus hobartsmithi Taylor

A group of thirteen small frogs (No. 54-37 to 54-49) obtained March 17, 1954, about five miles east of San Blas were taken from under stones in a dried river bed in a heavily forested area. They were very fast and elusive, many escaping by burying themselves in mud. Dr. Taylor and Dr. Smith identified these newly transformed specimens and pointed out 1) that three specimens possess a significant color variation (streaked pattern on a light dorsal ground color) and 2) that the specimens were from a much lower altitude than heretofore recorded for the species (below 500 feet in contrast with central plateau habitat). If correctly

referred to *hobartsmithi* these examples are a state record. Adult specimens from this locale are much to be desired.

Leptodactylus sp.

Two small, recently transformed frogs (No. 54-35 and 54-36) taken with a series of *Microbatrachylus* five miles east of San Blas on March 17, 1954, measured 17 mm. total length. Dr. Taylor and Dr. Smith identified the specimens to genus, but regarded them as too immature to be placed in *melanonotus* or *occidentalis* with certainty.

Smilisca baudinii baudinii (Duméril and Bibron)

This large hylid (No. 54-59) was found at night on 18 March 1954 crossing the road in an area of cohune-amate forest east of San Blas. It measured 90 mm. The dorsal color was light tawny brown with a pattern of dark brown blotches, each finely margined with black. The limbs were barred with the same dark color. The ventral skin had a coarse granular texture, and was whitish, becoming yellow-orange on the lower abdomen and thighs, marbled on the flanks, and with a dusky suffusion along the chin margin.

Hyla smithi Boulenger

Two small, delicate, arboreal frogs were taken March 1954 from the leafy axils of a bromelia near the pueblo of Singaita, eight miles east of San Blas. The male measured 18.0 mm., the female 18.5 mm. Dr. Edward H. Taylor identified these immature specimens.

Phyllodactylus lanei Smith

No. 54-73 was shot at about noon March 21, 1954, on boulders beside the road one-half mile south of the Río Acaponeta. It was alert, rapid, and had to be shot repeatedly (unlike other lizards) with dust shot before it slowed enough to be captured. It measured 68 mm. snout-vent, 76 mm. tail. There are six longitudinal rows of enlarged scales on the tail (instead of eight). The occipital scales are no larger than the other dorsal scales. The interorbital scales numbered twenty.

The dorsal ground color was flesh-yellow, upon which was imposed a pattern of dark brown, closely grouped chromatophores forming irregular and poorly defined transverse bars, this pattern more distinct on the tail where eleven bars could be counted. The ventral ground color was immaculate pale flesh-yellow, except for darker mottling on the tail. The iris was brown with a golden sheen. All colors were much paler in death.

Anolis nebulosus (Wiegmann)

Small anoles were commonly seen along house walls, fence rows, and road edges. Six specimens were preserved, two from a large bromelia (No. 54-30 and 54-34) and four from banana plantations (No. 54-52, 54-55, 54-60, 54-61). All were very similar in scutellation, color, and general morphology. The ventral scales were larger than the dorsals, and both were keeled. The occipital scale was larger than the ear opening, the supraorbital scales were three to four in number, and enlarged postanals were only seldom evident. The circumorbitals were broadly in contact medially. The gular pouch was red in life, pink when preserved.

Other observers have described a different gular coloration in this species. Perhaps only a complete revision of the genus will settle the many problems of correct diagnosis of the Mexican forms.

Iguana iguana rhinolopha Wiegmann

One sight record for Cerro de la Contaduria, San Blas, was noted on March 19, 1954.

Ctenosaura pectinata (Wiegmann)

This iguana was rather common along rocky hillsides, stone fences, or small hilltops. It avoided heavy forested areas. At Cerro de la Contaduria, San Blas, individuals escaped close approach by diving or falling down the steep cliff!ike hillsides, breaking branches in their course, and stirring up a great clatter of stones.

Two specimens were obtained. No. 54-56 measured 274 mm. snout-vent, 465 mm. tail, and weighed slightly over 16 ounces. The stomach was filled with flower stems and corollas. The generally black color paled somewhat after death. No. 54-71, a damaged DOR, measured 305 mm. snout-vent, 494 mm. tail.

Sceloporus melanorhinus calligaster Smith

A large, pale gray, female Sceloporus was shot on a prostrate gray-barked tree about four miles east of San Blas on March 17, 1954. The snout-vent length was 55 mm., tail 72 mm. Drs. Taylor and Smith very kindly examined and identified this immature specimen.

Sceloporus utiformis Cope

One example of this distinctive species (No. 54-33♀) was obtained on a log in a brushy locality four miles east of San Blas on March 17, 1954. The body length was 38 mm., tail 74 mm. The dorsal scales are large, keeled, mucronate, the lateral dorsal nuchals prominently larger than the other dorsal scales. The head scales are smooth, with one or two rows of fine scales between the median head scales and the supraorbitals and two to three rows between the supraorbitals and supraciliaries. The lateral scales are granular, the ventrals pointed. Coloration: body with eight narrow transverse bars between two prominent cream-white dorsolateral lines; tail with fifteen similar bars, continuous ventrally; a fainter barring of all limbs; dorsolateral line clearly defined from ear to the fourth dorsal dark bar, separating the large dorsal scales from the lateral granular ones; bright yellow vertical markings precede and follow the second transverse bar (on the neck); head brown with a vertical black bar through the eye; nape paler brown, dorsal ground color gray; abdomen very pale green, throat white and washed with dusky.

The relationships of this species within the genus, and the functions of the deep nuchal pocket and unusual, large, shallow, ear opening seem intriguing subjects for future investigation.

Sceloporus horridus albiventris Smith

One female specimen (No. 54-72) was taken at the type locality (Tepic) March 21, 1954. This individual measured 61 mm. snout-vent,

108 mm. tail. It was a large, rough-scaled lizard, pale gray-brown above, with a prominent pattern of two rows of black spots, each bordered medially and posteriorly by gray-white. Two lateral light lines were present, the more ventral ending at the thigh insertion, the more dorsal continuing onto the tail. The axillae, forearms, and inner thighs were bright yellow. The belly was immaculate shiny white with a faint enamel-like gloss of orange. A pale bluish coloration appeared on the ventral surfaces after fixation. This species has a deep nuchal pouch below and behind the ear, covered by a fold of skin.

Sceloporus nelsoni Cochran

Five specimens (No. 54-67 ♂ 53 mm. snout-vent, 75 mm. tail; 54-68 ♀ 42 mm. snout-vent, 69 mm. tail; 54-69 ♀ 41 mm. snout-vent, 48 mm. tail; 54-70 ♀ 45 mm. snout-vent, 65 mm. tail; 54-75 ♀ 51 mm. snout-vent, 74 mm. tail) were obtained between the Río Acaponeta (northern boundary of the state) and San Blas on the coast. These specimens had twelve to fifteen femoral pores and plainly marked, blue diagonal converging chin bars. The dorsal color was dark brown with faintly visible light dorsolateral lines. The interparietal dark spot, vertical lip bars, and transverse barring of the limbs, were all boldly contrasted with the ground color. There was a large black shoulder patch, prolonged dorsally to form a vertical bar on the neck. This lateral neck bar was edged posteriorly with yellow.

Compared with the closely related *Sceloporus pyrocephalus* Cope of more southern distribution, and a few specimens of *S. nelsoni* collected in Sinaloa, there seems to be a tendency for more northern examples of the pyrocephalus group to lose or obscure the diagonal dark bars of the chin.

Cnemidophorus sacki communis Cope

Five specimens were taken, three near San Blas (No. 54-54, ♂ 72 mm. snout-vent, 180 mm. tail; No. 54-62, ♀ 51 mm. snout-vent, 127 mm. tail; No. 54-66, ♂ 62 mm. snout-vent, 158 mm. tail; 18 and 19 March 1954) and two from the vicinity of Río Acaponeta, where crossed in northern Nayarit by the Pacific highway (No. 54-74, ♂ 99 mm. snout-vent, 171 mm. tail; No. 54-76, ♂ 61 mm, snout-vent, 152 mm. tail; March 21, 1954). No variations in scutellation were noted in comparing these individuals with previous descriptions of the species. Color notes made before preservation of a typical example, No. 54-74, are as follows:

Above mainly brown; a paravertebral buffy line less distinct posteriorly, and a prominent pale buff lateral line beginning at the supraorbital ridge, becoming less distinct at the level of the vent, but continuing onto the tail; a prominent white line beginning on the lower eyelid and continuing to the insertion of the hind leg, curving over this insertion and continuing onto the tail, where it is poorly separated from the ventral coloration by buffy-brown scale mottling; between the paravertebral and lateral lines, a row of more or less confluent black spots; below the lateral line, a second row of black spots on a red-brown ground color; dorsum of head dark brown, tail brown, thighs tan with faint black rosettes; abdomen white with pale orange sheen, and blue between the scales; under surfaces of tail and hind legs orange-yellow.

Other examples had pink subcaudal color, this found also on legs, feet, and hands. No. 54-76 differed in having a dark line medial to the paravertebral white line, and all of the dark lines more nearly solid. The dorsum of the thighs were marked with black irregular longitudinal streaks, becoming a marbling on the legs.

Masticophis flagellum lineatus (Bocourt)

A large dry (shed) skin (No. 54-58) found on beach dunes at San Blas is probably of this species.

Trimorphodon paucimaculatus Taylor

Two dead specimens were found on the highway near San Blas in cohune palm jungle. Both were marbled red-brown below, the dorsal color coppery with a darker copper-brown pattern of twenty-two blotches. No. 54-22 measured 656 mm. snout-vent, 145 mm. tail. No. 54-31 was 702 mm. snout-vent length, 148 mm. tail.

Leptodeira maculata (Hallowell)

This gentle, slow-moving snake was found in the hollow dried leaf axil of a large bromelia, eight miles east of San Blas. The epiphyte was about six feet from the ground on one of a group of trees set in a grassy open space surrounded by palm and fig jungle. Two small hylid frogs and two Anolis were found in other parts of the same plant. Scalation: ventrals 174, caudals 69, anal divided; supralabials 8 - 8, the fourth and fifth entering the eye; infralabial 10 - 10; preoculars 1 - 1; postoculars 2 - 2; temporals 1+3+4; scale rows 20-23-17.

Coloration: Above light brown, washed with blackish; twenty-seven prominent black dorsal blotches, some confluent; eleven black blotches on tail; nuchal collar 3-4 scales wide. Chin and ventrum creamy white. Measurements snout-vent 457 mm., tail 117 mm. The specimen was a female.

Natrix valida valida (Kennicott)

A black male *Natrix* was obtained at Playa Matanchen near San Blas, on March 18, 1954. The specimen measured 391 mm. snout-vent, 137 mm. tail. The scale counts were: ventrals 139; caudal pairs 75; preoculars 1 - 1; postoculars 3 - 3; upper labials 8, the eye entering 4 and slightly onto 5; lower labials 10; temporals 1+2+3 right, 1+3+3 left; anal plate divided; scale rows 17-19-17; loreal present; no scale pits.

Coloration: shiny black on dorsum of head, and ventrally; dull black elsewhere; some chin shields diffusely marked with gray-white; ventral scales gray at lateral extremities, then tipped with black, forming thus a narrow black stripe; scale rows 1,2 and 3 dark gray.

This specimen resembles most closely *Natrix valida celaeno* (Cope) (black form) as defined by Conant. Since that subspecies is confined to Baja California the present specimen should be referred to *Natrix valida valida,* and is, I believe, the first melanistic example of this subspecies to be recorded.

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NOTES ON A SMALL COLLECTION OF REPTILES FROM COAHUILA, MEXICO.—During the middle of June, 1955, I had the opportunity to make a small collection of reptiles near the town of Parras de la Fuente, Coahuila, México. Among the specimens collected are representatives of three species that are of particular interest. All of the specimens are deposited in the University of Michigan Museum of Zoology, to which collection the catalogue numbers refer.

Coleonyx brevis Stejneger

One specimen (112926) was collected 1½ km. northwest of town on June 13. This specimen was found on a hillside beneath an igneous boulder, and when exposed it made no attempt to escape. In life, the bands across the body were bright orange and were separated by zones of bright yellow. The specimen, a female, is 91 mm. in total length and 43 mm. in tail length.

This species had previously been known in Coahuila only from Saltillo and Monclova.

Sonora semiannulata blanchardi Stickel

A single specimen (112932) of this snake, found at the same locality and on the same day as the *Coleonyx brevis*, was under a porous and limey block of conglomerate.

The color in life consisted of 37 black rings on the body and 17 on the tail. These are about two scale lengths wide and are separated from each other by a zone of light red three scale lengths wide. There was an extremely fine white line between the black and the red. On the fourth scale row the red begins to fade into the white ventral color. On the posterior half of the body and on the tail, the black bands are continuous across the ventrals and the caudals.

The scale counts are: dorsals 16-15-14; ventrals 159; caudals 55; upper labials 7-7, the fourth and fifth entering the orbit; lower labials 7-7; temporals 1-2, 1-1. The specimen, a male, has a total length of 298 mm. and a tail length of 64 mm. (21.4 per cent of the total length).

This subspecies has previously been known in Mexico only from the state of Chihuahua; this record extends the range approximately 300 miles to the southwest.

Thamnophis m. marciana x *m. nigrolateris*

Four specimens (112933-4) that clearly show intergradation between the two subspecies of *T. marciana* were collected 3 km. north of town on June 11 and 13. Three juveniles were found beneath clods of sod beside an irrigation ditch in a vineyard, and an adult male was collected nearby, just as it was about to crawl down a rodent burrow.

The scale characteristics of these four specimens are:

Number	Ventrals	Caudals	Total Length	Tail Length	Sex
112933	164	67	543 mm.	115 mm.	♂
112934	163	70	194	43	♂
"	151	60	179	37	♀
"	154	62	179	38	♀

The supralabials are 8-8 in all specimens, the fourth and the fifth entering the orbit.

The scale reduction formulae for the four specimens are:

Males	21—5+6 (75-78)—19—4+5 (88-91)—17
Females	21—5+6 (64-69)—19—3+4 (81-88)—17

—Fred G. Thompson, Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

THREE NOTABLE RECORDS OF THE MARBLED SALAMANDER IN NORTHERN OHIO.—Until now, the distribution in Ohio of the salamander *Ambystoma opacum* (Gravenhorst) was believed to be within the unglaciated section of the Appalachian Plateau and the region of Cincinnati. Recently three notable unpublished records of this salamander in northern Ohio came to my attention. These are as follows:

(1) Clev. Mus. Nat. Hist. 458, Ohio, Lake Co., Kirtland Twp., Holden Arboretum. Collected Aug. 31, 1951, by Mr. Michael Turnauckas of the Cleveland Zoo.

(2) Clev. Mus. Nat. Hist. 748 and 749, Ohio, Lorain Co., Elyria Twp., 3¼ miles north of Elyria. Collected May 17, 1953, by Fred Thompson and Robert Maly.

(3) Univ. Mich. Mus. Zool. 77349, Ohio, Henry Co., near Colton. Collected Mar. 23, 1953, by Roger Conant and M. B. Trautman.

No. 458 was discovered under a log near a woodland pond and was in association with another specimen which escaped down a mole burrow. After its death the captured specimen was presented to the Cleveland Museum of Natural History by Mr. Fletcher Reynolds, director of the Cleveland Zoo.

Both No. 748 and No. 749 were found in the vicinity of an abandoned sandstone quarry during a rainy day. The two specimens were on relatively high, rocky ground in a beech-maple climax forest and discovered in close association with specimens of *Ambystoma maculatum, Plethodon glutinosus* and *P. cinereus*. No. 748 was walking on the forest floor in the rain, while No. 749 was nearby under a large slab of sandstone.

No. 77349 was brought to my attention through the courtesy of Dr. Charles F. Walker, who verified the identification of the specimens in my possession.

The importance of these three records is best illustrated by the published accounts of this species in Ohio. The most northern recorded locality for Ohio is Lancaster, Fairfield Co. (Morse, Proc. Ohio Acad. Sci. 4(3): 108, 1904). The range extension from Lancaster for the three above records is 150 miles N.N.E., 110 miles N., and 130 miles N.N.W., respectively. The extension of the range by these records is from south-central Ohio to the Lake Erie region. However, that the species is thoroughly distributed throughout the state cannot be determined until the areas now appearing as large gaps are more extensively explored. —Fred G. Thompson, Dept. of Zoology, Cleveland Museum of Natural History, Cleveland, Ohio.

AN ANOMALOUS CONDITION OF THE LIVER OF A YOUNG *PYTHON SEBAE*.—Upon dissecting a young female specimen of *Python sebae* Gmelin, I observed the liver to be transversely split into two portions. The anterior portion was comparatively small, and tapered to a point cranially. The posterior portion was in no way continuous with the anterior body; the two entities were completely separated. Each was enclosed within a discrete liver sac, paired as is normal.

The vena cava emerged from the anterior substance of the hinder-most body of the liver, and passed to the anterior body where it ran visibly along its median ventral line. The vein then continued forward to communicate with the right atrium of the heart. The relationships concerning this vessel and the two liver portions are shown in the accompanying figure.

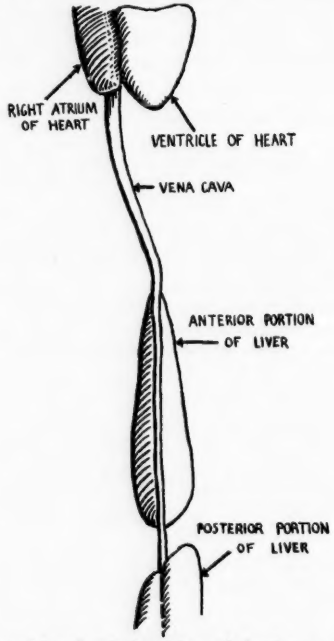


Fig. 1. The positional relationships of the heart, the two portions of the liver, and the vena cava, as seen from a ventral view.

The distance from the posterior tip of the heart to the anterior extremity of the anterior body was 38 mm.; and the length of the latter organ was 40 mm. The posterior portion of the liver measured about 135 mm. The space between the caudal margin of the anterior liver and the cranial tip of the posterior portion of the liver measured about 5 mm. The total length of the specimen was 1252 mm.—T. H. Frazzetta, 241 Glen Cove Ave., Sea Cliff, N.Y.

A New Subspecies of *Bufo woodhousei* From the Inland Southwest

By FREDERICK A. SHANNON and CHARLES H. LOWE, JR.

Subspecific differentiation between animal populations of southern and northern Arizona is now known to be a common phenomenon. It is often found correlated, as in the present case, with spatial isolation for lowland forms engendered by the highly elevated central portion of Arizona north of the Mogollon Rim. The forested Mogollon Rim and associated mountains constitute an elevated area extending roughly east-west across most of central Arizona into western New Mexico, between parallels 34° and 35°.

The type locality of *Bufo woodhousei* Girard is Flagstaff, Coconino County, Arizona, in the northern portion of the state, north of the Mogollon Rim. We have secured large series of this form (*B. w. woodhousei*) in northern Arizona, as well as large series of the distinctive form occurring in southern Arizona, south of the Mogollon Rim. We describe this southern form as

Bufo woodhousei australis subsp. nov.
SOUTHWESTERN WOODHOUSE TOAD

Holotype. No. 6817, an adult male in the collection of Frederick A. Shannon, Wickenburg, Arizona. Collected April 6, 1955, at 8:30 p.m., by Albert Maas, in a damp irrigation ditch within the city limits of Tempe, Maricopa County, Arizona.

Paratypes. Charles H. Lowe, Nos. 3488, 6702-04, 6708, 6711; F.A.S. Nos. 1577-79, 1581-83, 2918-2937.

Diagnosis. Similar to *B. w. woodhousei* but distinguished by: (1) distinct narrow interorbital ridges, separated by a normal frontal trough, without a frontal elevation of the cranium; (2) ratio of snout-vent length to parotoid width, 10.11 ± .25 (7.3-12.8); ratio of snout-vent length to parotoid width, 5.03 ± .16 (3.6-7.4); (3) skin of upper surfaces greatly spinose; (4) median longitudinal white line absent from snout (80%); (5) black pectoral semicircles on ventrum well developed (87%); (6) the larger warts of the dorsum set in well developed black blotches.

Description of the holotype. Interorbital crests prominent, rough, nearly parallel (slightly convergent anteriorly); intercranial area rough, pustular, not noticeably elevated; preorbital crest present, not distinct; parietal crests absent, or barely noticeable; postorbital crests prominent, as high as and at right angles to interorbital crests; interorbital area slightly wider than distance from eye to nostril; dorsal surface of eyelid with large, coarse, keratinized pustules; tympanum subcircular, vertical, relatively smooth; diameter of tympanum slightly less than that of eye; no supratympanic fold; canthus rounded; external nares small, directed dorsolaterally; snout rounded, tip half way between nostril and lip.

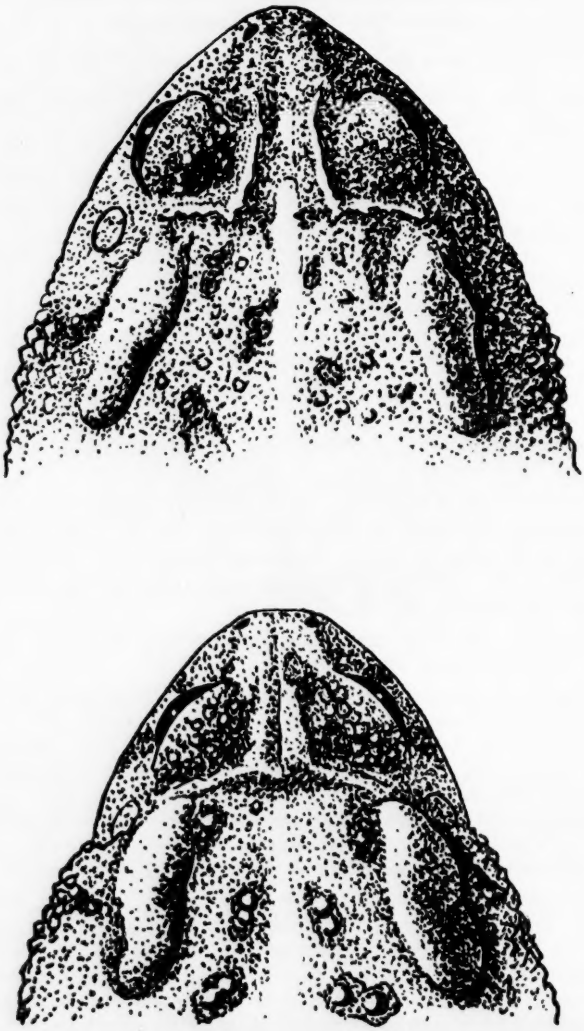


Fig. 1: Upper—*Bufo woodhousei australis,* FAS 6817, holotype from Tempe, Maricopa County, Arizona (X2). Lower—*Bufo woodhousei woodhousei,* FAS 3779 from 3 mi. E. Betatakin Jct., on Kayenta Road, Navajo County, Arizona (X2).

Tongue boletoid, attached anteriorly, free posteriorly; vocal ostia present on both sides, parallel to tongue; choanae large, widely separated, partially hidden.

Parotoids elongate, diverging posteriorly, studded with widely spaced, small, keratinized pustules, especially on lateral surfaces. Dorsum rough, covered with pustules varying in size from small and pebbly to large and keratinized; a dorsolateral row of large pustules from beneath midpoint of parotoids to groin; a patch of large pustules present behind corner of mouth, another on dorsal surface of tibia; pustules on dorsum of brachium and antebrachium, pebbly and keratinized; pustules beneath dorsolateral row pebbly and becoming less keratinized as venter is approached.

Hypothenar eminence large, flat; thenar eminence about one-fourth size of hypothenar, flat; ventral metacarpal surfaces highly pustular. Proximal subarticular tubercle on all fingers, that of thumb large, slightly bifurcate; distal subarticular tubercles of third and fourth fingers bifurcate; digital formula, 3-4-1-2; no trace of web between fingers.

Medial tibiotarsal fold evident as a line of low-lying, keratinized tubercles, medial metatarsal tubercle large, flat, lacking a cutting edge; lateral metatarsal tubercle prominent, rounded, about one-third size of medial; ventral metatarsal surface tubercular, tubercles of fifth metatarsal linear and faintly keratinized; one subarticular tubercle on second toe, two on third, three on fourth, and two on fifth; toes about two-thirds webbed; bilateral fringe on fourth toe to terminal phalanx; digital formula, 4-3-5-2-1.

Ventral surface coarsely pebbled, becoming macular posteriorly. Vocal pouch large, finely pebbled.

Color of holotype from life. Dorsal color pale olive brown. Dorsal tubercles chocolate colored with brown keratinized tips; occasional tubercles lighter than, or as light as, ground color; larger tubercles partially or completely bordered with black, black borders encircling one to three or four tubercles; smaller tubercles usually not bordered with black. A pale creamish vertebral stripe evident extending from rump to between cranial crests. Lateral surfaces of body marked with vague, longitudinal bands of same color as vertebral stripe, these lateral bands marbled and broken by gray-black pigmented areas, but the dark pigment not extending onto the tubercles comprising the larger portion of the light lateral band. Thighs, especially the posterior portion, suffused with dark marbling relieved by sulfur yellow tubercles; elsewhere on legs the dark pigmentation alternating obscurely with cream-yellow to form transverse bands of both colors. Pupil horizontal; cornea golden, heavily stippled with black and, to a lesser extent, brown; pupil bordered with brilliant yellow line; upper scleral border pale green.

Venter cream, throat black with sparse cream or yellow punctations tympanum light tan; brachium obscurely banded or marbled with gray-black and yellow, changing to sulfur yellow in axilla; antebrachial surfaces banded with gray and cream. Dorsal surface of first and second finger (breeding patch) rich velvet brown; rump pinkish.

Measurements of holotype in millimeters. Total length, 75.0; head length, 20.0; head width, 31.0; interorbital width, 6.56; internasal width,

4.60; nostril-eye, 6.00; eye diameter, 7.4; left parotoid length, 14.9; left parotoid width, 7.2; diameter of tympanum, 6.85; length of vocal ostia, 5.50; length of femur, 35.6; length of tibia, 31.5; length of hind foot, 49.0. Ratio of snout-vent length to parotoid width, 10.41; ratio of snout-vent length to parotoid length, 5.03.

Variation. There is a remarkable uniformity in the Arizona population of *australis.* The interorbital crests in occasional specimens converge rather sharply anteriorly. In old individuals there may be considerable geriatric hypertrophy of these crests, to form a sort of shelf between them. This is in no way comparable to the elevated intercranial area of *B. w. woodhousei.* In this plateau population the interorbital crests, while well defined, are not rugged like those of *australis.* The boss between them rather completely blends with the medial border to create a rather smooth elevated frontal area which is in marked contrast to the similar area of *australis* (See lower Figure).

For the area west of the Continental Divide, it may be stated that *B. w. australis* is larger than *B. w. woodhousei.* A male *australis* from Tempe, Arizona, has a snout-vent length of 102 mm. which exceeds the maximum for *Bufo woodhousei* reported by Wright and Wright (1949: 206) and by Bragg (1950:40). Bragg (*loc. cit.*) reports a female of *woodhousei,* from Kay County, Oklahoma, which measured 126 mm. snout to vent in the living condition.

While individuals of *australis* may have considerable green in their color pattern, there is nearly always a component of brown which is much less developed or absent in *B. w. woodhousei.*

Distribution: Southern Arizona, southern New Mexico, southwestern Texas, into northern Mexico adjacent to these states.

Our casual examination of specimens from several western and midwestern states reveals the probable existence of other distinctive subspecies in this relatively wide-ranging species occurring over most of the western United States and much of northern Mexico.

Nomenclature. Cope (1866: 301) described *Bufo frontosus,* currently treated as a synonym of *B. w. woodhousei,* collected by Dr. Elliott Coues "during a sojourn of sixteen months in and 'travels over the Territory of Arizona from east to west, chiefly near the parallel of 35°, and along the valley of the Colorado from Fort Mojave to Fort Yuma.' " The type of *B. frontosus* is lost. From Cope's (*loc. cit.*) description, we are able to recognize without difficulty *B. frontosus* as a synonym of *B. w. woodhousei* rather than of *B. w. australis.* We revise, by subsequent restriction (Smith, 1953: 38) the type locality of *B. frontosus* to Winslow, Navajo County, Arizona, ". . . near the parallel of 35° . . ." a locality within the known range of *B. w. woodhousei* and one at which the species has been collected. Smith and Taylor (1950: 353) restrict the type locality of *B. frontosus* to old Fort Mojave, Mojave County, Arizona. Schmidt (1953: 66) restricts the type locality to Tucson, Pima County, Arizona. Reasons for these revisions are not given, but they must be rejected as they do not lie within the range of *frontosus.**

TABLE 1.

Character	N	*B. w. australis*	*B. w. woodhousei*	d
Frontal area of cranium	30	not elevated (100%)	elevated (90%)	
Ratio, S-V L./ Parotoid W.	30	10.11 ± .25 (7.3 - 12.8)	11.65 ± .26 (9.5 - 15.8)	.001
Ratio, S-V L./ Parotoid L.	30	5.03 ± .16 (3.6 - 7.4)	5.41 ± .13 (4.6 - 8.6)	ca. .05
Skin of upper surfaces	50	greatly spinose	smooth to spinose	
Median white line on snout	30	absent (80%)	present (57%) absent (43%)	
Black pectoral semicircles	30	strongly developed (87%) weakly developed (10%) absent (3%)	strongly developed (16%) weakly developed (47%) absent (37%)	
Dorsal pattern	50	larger warts on dorsum set in well-developed black blotches	larger warts on dorsum set or not set in black blotches; black blotches well-developed, weakly developed, or absent.	

*It is to be regretted that the 14th International Congress of Zoology did not employ Smith's (*supra cit.*) useful "revisions" of type localities as a more general term with "restrictions of type locality" being a specific example. Thus the Congress states (Copenhagen decisions on zoological nomenclature, 1953, p. 27): "When two or more authors publish restrictions for the locality of a nominal species, the principle of priority shall apply, except when, as provided above, the later author further restricts the locality specified by the earlier author." It must be assumed that "restriction" in the above sense means "revision." Mark Twain was able to restrict St. Louis to New Orleans by pointing out the fact that the Mississippi River between the two cities was becoming shorter every year, and thus deducing that by projection St. Louis would one day be in New Orleans. Neither Tucson nor Fort Mojave are connected by river with Winslow; thus it would be difficult to "further restrict" them to Winslow.

Comparisons. Our material of *B. w. woodhousei* has been representative of populations in the states of Arizona, Utah, and Idaho. That from northern Arizona has been secured by us from Coconino and Navajo counties. From this northern Arizona material of *B. w. woodhousei* we have drawn random samples of 30 and 50 specimens for comparative study. Our material of *B. w. australis* has been representative of populations in the states of Arizona, New Mexico, and Texas. That for southern Arizona has been secured by us from Maricopa, Gila, Pinal, and Pima counties. From this southern Arizona material of *w. australis* we have drawn random samples of 30 and 50 specimens for comparison with *w. woodhousei* of northern Arizona (thus from near the type locality for the species).

In Table 1 there is a comparison of characters of the two subspecies. Certain consistent features of color and pattern which are subtle in nature are not given in the table. Proper allocation is possible for approximately all of the individuals from either north or south of the Mogollon Rim in Arizona. We find *B. w. australis* to differ most consistently from *B. w. woodhousei* of northern Arizona in lacking the conspicuously elevated interorbital (frontal) cranium, in having larger parotoid glands, a more spinose skin, a subtly different color pattern, and a larger body.

LITERATURE CITED

Bragg, A. N. 1950. Data on size range in adults of *Bufo w. woodhousii* Girard. Proc. Okla. Acad. Sci., 31: 39-40.

Cope, E. D. 1866. On the Reptilia and Batrachia of the Sonoran Province of the Nearctic Region. Proc. Acad. Nat. Sci. Phila., 18: 300-314.

Schmidt, K. P. 1953. A check list of North American amphibians and reptiles. Univ. Chicago Press, pp. viii-280.

Smith, H. M. 1953. Revision of type localities. Systematic Zoology, 2 (1): 37-41.

Smith, H. M. and E. H. Taylor. 1950. Type localities of Mexican reptiles and amphibians. Univ. Kans. Sci. Bull., 33 (8): 313-380.

WICKENBURG and TUCSON, ARIZONA

REDISCOVERY OF A MEXICAN LIZARD, *BARISIA IMBRICATA PLANIFRONS* (BOCOURT).—A mature male *Barisia imbricata planifrons* (Univ. Ill. Mus. Nat. Hist. No. 37324) secured by Mr. Thomas MacDougall at Santa Domingo Lachivitó, Oaxaca, 140 miles SE of the city of Oaxaca, November 18, 1954, at an altitude of 8000 feet, is of special interest as being the first of this form for which precise locality data are available (Tihen, 1949, Univ. Kans. Sci. Bull., 33: 246-7).

Gerrhonotus (Barisia) planifrons was proposed by Bocourt (Miss. Sci. Mex., Rept., livr. 5, pl. 21C, 1878; the 1879 description referred to by Tihen is not the earliest date for the name) for two specimens whose locality was given only as "Oaxaca." Since Bocourt's description, only two other specimens have been reported. These were intergrades between *B. i. imbricata* and *B. i. planifrons* from Cerro San Felipe, Oaxaca, reported by Tihen (*op. cit.*). The present specimen affords an opportunity for further elucidation of range, relationships, and characteristics.

In scutellation and coloration the specimen agrees very well with Bocourt's (*op. cit.*, livr. 6, 1879, p. 361) diagnosis and with Tihen's (*loc. cit.*) characterization of the form. Among the differences from *B. i. imbricata* (Wiegmann) that merit special emphasis are the 16 longitudinal rows of dorsals, 36 transverse rows of dorsals, failure of contact of lowest primary temporal with the penultimate supralabial, reduced number of superciliaries (4-3), and the paired postmental (extremely asymmetrical in the present specimen, the left being only one-tenth the size of the right). In addition three other differences between *B. i. planifrons* and *B. i. imbricata* are supported by the present specimen: (1) small adult size—the present specimen with a snout-vent length of 60 mm. possesses a mature testis and vas deferens; Bocourt (*op. cit.*: 362) cites his largest as 93 mm. snout-vent, as compared with *B. i. imbricata* which averages 110 mm. snout-vent and reaches a maximum of about 126 mm. (Tihen, *op. cit.*: 245); (2) light edging of dorsal scales (absent in *B. i. imbricata*); and (3) size of lateral nuchals. With respect to this last character, 14 is the minimum count possible in a dorso-ventral plane between ear opening and lateral nuchal pocket, whereas 9 is the minimum in 20 *B. i. imbricata* examined. Further specimens will reveal the extent of reliability of these additional characters, which do however appear sound because they are reliable in separating *B. i. imbricata* and *B. i. ciliaris* (Smith).

Since the present specimen provides the only known locality for the subspecies, we hereby restrict the type locality for *B. i. planifrons* to Santa Domingo Lachivitó, Oaxaca.

Of more than casual interest is the striking parallelism (as stated by Tihen, *op. cit.*: 247) of the two forms *B. i. ciliaris* and *B. i. planifrons*, respectively the northern and southern relatives of *B. i. imbricata*. The peripheral forms are alike, and different from *B. i. imbricata*, in (1) having more numerous longitudinal rows of dorsals, (2) light edging on the dorsal scales, and (3) small lateral nuchals (they count out at the same minimum in both forms.) Each of the races of *B. imbricata* has certain unique features, but the possession of so many common characters by the peripheral races *B. i. ciliaris* and *B. i. planifrons* is certainly of significance.

It is not now clearly apparent whether the shared features (1) are a result of independent orthoevolutionary specialization from an ancestral stock resembling *B. i. imbricata,* or instead (2) are primitive, having independently been retained from an ancestral species whose most specialized derivative is *B. i. imbricata.* It is of interest to observe that a differential in selective pressure clearly has been involved in the evolution of these races; and that the greater probability rests with the hypothesis of peripheral rather than central differentiation, since survival in peripheral areas (that may be looked upon as zones where survival potential of a given animal type approaches equality with unfavorable environmental pressures) is subject to greater hazards than in more nearly optimum central areas.—Harold Wm. Kerster and Hobart M. Smith, Univ. Ill. Mus. Nat. Hist. and Dept. Zool., Urbana, Ill.

A LONGEVITY RECORD FOR THE TEXAS BLIND SALAMANDER.—The rather rare Texas blind salamander, *Typhlomolge rathbuni* Stejneger, has been of some interest as an experimental animal because of its lack of functional thyroid glands (*e.g.* Kezer, J., Thyroxin-induced metamorphosis of the neotenic salamanders *Eurycea tynerensis* and *Eurycea neotenes,* Copeia, 1952, p.235). Our experiences with this animal at Steinhart Aquarium are thus of corollary interest.

During April 1952 we obtained on exchange from the San Antonio Aquarium a four-inch, splindly-legged but healthy individual of *Typhlomolge.* It had been collected at San Marcos, Texas (date unknown), and it was of indeterminate age. Details and photos of this specimen were reported earlier by the writer (Texas blind salamander in the aquarium, Aquarium Journal, vol. 23, No. 8, p. 149-152, Aug. 1952). At the aquarium it became the sole occupant of a 14 gallon display tank (16" x 13" base x 15" height). Subdued light came into the tank only from the front as the three sides and top were painted. Three-quarters of the chlorine-free tap water used in the tank was replaced each week. The temperature was uncontrolled ranging from about 60 degrees Fahr. in the winter, to about 75 degrees in the summer. As indicated in my earlier paper *Typhlomolge* can withstand an 85 degree temperature for a short period although the water of its normal underground habitat is fairly constant between 69 and 70 degrees. When placed in the display tank during the early part of May, 1952, the *Typhlomolge* measured exactly four inches in total length, and upon death, January 25, 1955, measured 4 3/16 inches. This contrasts with a maximum known length for the species of 5½ inches. Thus, in the 32 months of captivity, the specimen had grown only 3/16 inches on a constant diet of brine shrimp (*Artemia saliens*). There was no indication of the cause of death and the specimen was placed in the reference collection of the California Academy of Sciences Department of Herpetology (No. 85009). It should be noted that the San Antonio Aquarium has previously kept *Typhlomolge* for 18 months.

Of one thing we are certain—despite its fragile appearance, *Typhlomolge rathbuni* is a much tougher salamander than many of our other species.—Earl S. Herald, Steinhart Aquarium, California Academy of Sciences, San Francisco 18, California.

New and Noteworthy Mexican Lizards of the Genus *Anolis*

By HOBART M. SMITH and HAROLD W. KERSTER

Examination of some Mexican anoles in the University of Illinois Museum of Natural History (to which cited numbers refer, unless otherwise specified) has revealed noteworthy range extensions for eleven species and the existence of a previously undescribed species of the *humilis-tropidonotus* group. Part of the specimens were secured by the senior author during tenure of the Walter Rathbone Bacon Traveling Scholarship of the Smithsonian Institution. Most of the Bacon specimens were retained by the U. S. National Museum; their numbers are indicated by the prefix USNM. Other reported specimens were secured by Mr. Eizi Matuda, presently of Mexico City; we are greatly indebted to him, not only for the present specimens, but also for his generous hospitality in earlier years. The remaining specimens here reported were secured by Mr. Thomas MacDougall, whose explorations of remote fastnesses of the Isthmus of Tehuantepec have long been a totally unique service to many students of Mexican biology.

We are indebted to Dr. L. C. Stuart for providing us with a manuscript copy of his forthcoming review of the Guatemalan anoles, and for very useful comments on some specimens here reported.

Anolis biporcatus (Wiegmann)

Three specimens (Nos. 15685-7) are from a locality between Juchitán and La Gloria, Oaxaca, on the north side of the Sierra, taken January-March, 1950, by Mr. Thomas MacDougall. This is the second locality of record for this species in Mexico.

Anolis capito Peters

A single specimen (USNM) was collected by the senior author at Piedras Negras, Guatemala. It is a juvenile (44 mm. snout to vent) but has the very distinctive snubnosed appearance and flat dorsal scales of this species. The occurrence of the species in Mexico, where it has been recorded only from "Tabasco," is supported by the present specimen.

Anolis compressicauda sp. nov.

Holotype. Univ. Ill. Mus. Nat. Hist. No. 35625, collected near La Gloria, Oaxaca, Mexico, March 11, 1953, by Mr. Thomas MacDougall.

Paratypes. Natural History Museum of Tuxtla Gutierrez, Chiapas, Nos. 215, 218, 216, 217, from El Ocote, 600 m., near Ocozocoautla, Chiapas, April 15, 1955, collected by Miguel Alvarez del Toro; Amer. Mus. Nat. Hist. Nos. 65004-8, all from the vicinity of La Gloria, Oaxaca, collected by Mr. Thomas MacDougall.

Diagnosis. An *Anolis* closely related to *A. humilis uniformis* Cope and *A. tropidonotus* Peters; with tibia about equal to length of head (to anterior edge of tympanum); forehead strongly concave; supraorbital semicircles separated by two or three series of scales; a few enlarged supraocular scales smaller than scales of frontal concavity; interparietal situated in a pronounced concavity; dorsal scales in about ten longitudinal rows, about twice as large as ventrals, sharply differentiated from lateral scales;

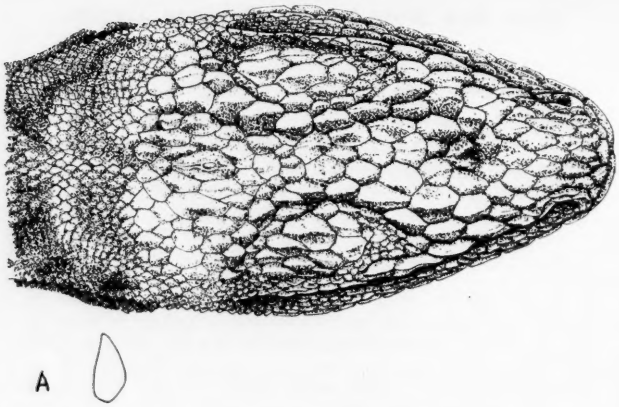


Fig. A. *Anolis compressicauda,* UIMNH 35625, holotype. Dorsal view of head, with relative size and shape of tympanum indicated at side.

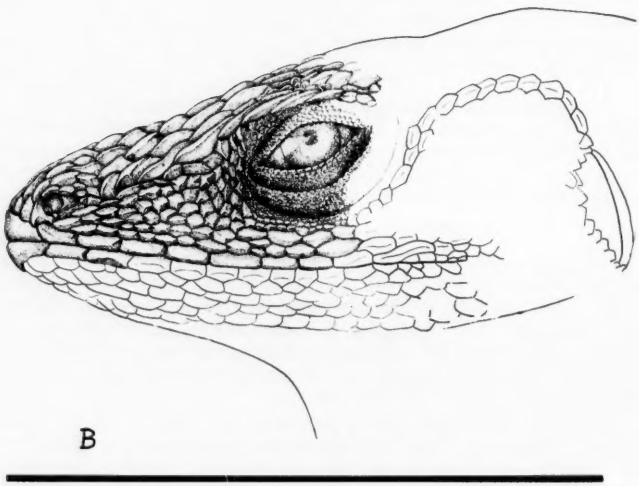


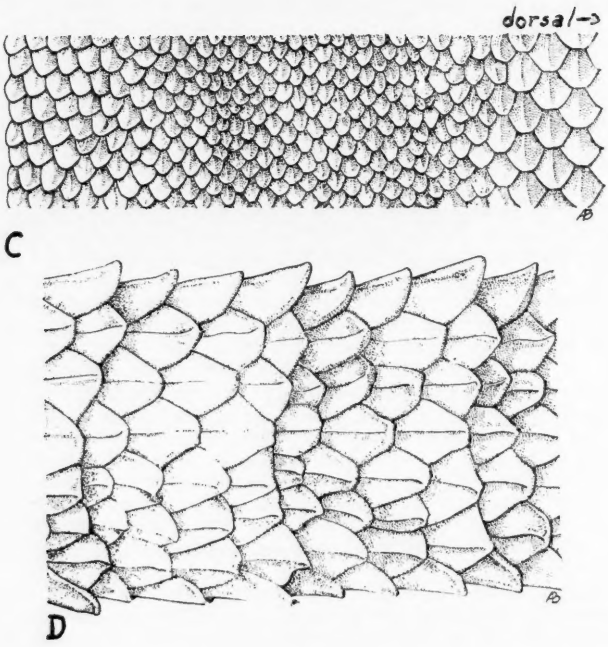
Fig. B. *Anolis compressicauda,* UIMNH 35625, holotype. Lateral view of head, with length of tibia indicated by a solid line below.

twelve lamellae under phalanges two and three of fourth toe; tail a little longer than snout-vent length, markedly compressed at least in the male.

Description of holotype. An adult male *Anolis* with large, sharply unicarinate scales tending to be thick and conical in cross section; pronounced frontal and occipital depressions; interparietal but slightly enlarged, narrow, about twice as long as broad; frontal ridges feebly marked, short, and divergent; ear opening large (3 mm. x 1.3 mm.), greatest diameter about equal to that of eye opening, ovoid, vertical; dewlap large, posterior end situated at a level about 3 mm. posterior to axilla; scales of supraorbital semicircles somewhat enlarged, but smaller than those of the frontal depression, separated by two or three series of scales; 7 or 8 elongate supraoculars; loreal rows seven; upper labials eight to below middle of eye; body short, slightly compressed; a very small dorso-nuchal fold; dorsal scales strongly keeled, in about ten longitudinal rows, 16 to a head-length (counted forward from middle of sacral region), sharply differentiated from the much smaller, strongly keeled laterals; ventral scales strongly keeled, about half length of dorsals (about 10-11 in 5 mm., or, by extrapolation, about 32 in a head-length), but larger than laterals, into which they grade insensibly; no enlarged postanal scales; tail markedly compressed (at heel measuring 4 mm. x 1.8 mm.), a little longer than head and body; a single middorsal series of caudals much enlarged; no evidence of a caudal fin; whorls poorly defined, 3 dorsal and 3 ventral scales, and about 4 lateral scale-lengths per whorl; twelve lamellae under phalanges two and three of fourth toe; digital dilations very narrow (max. width 1 mm.); a very deep axillary pocket; head length, 15.2 mm.; head width, 10 mm.; snout-vent length, 54 mm.; tail, 8 mm.; tibia, 15 mm.

Head greyish-brown above, white below, with two narrow, black, diagonal lines extending onto the rose-colored dewlap and curving back dorsally to end at the shoulder; lips barred with black; dorsum greyish-brown, graduating into black laterally and broken by seven narrow, transverse bands of white into eight chevron-shaped patches on each side; the venter white, with melanophores evenly distributed except for two transverse rows, the posterior of which is broken midventrally, of melanophore-free scales at the level of the hind limbs; limbs and tail yellow-brown, barred with brownish-black.

Variation. The paratypes include 2 males and 2 females, all adults. The relatively large size of ear opening, small size of ventrals, and dark longitudinal gular streaks hold constant in this series and appear to be the most useful diagnostic differences between *A. compressicauda* and *A. tropidonotus*. The relatively strong compression of the tail likewise is clearly distinctive in males; the tail is slightly less compressed in the females, but still exceeds that of male *A. tropidonotus*. The streaks on the dewlap and oblique bars on the sides of body are not evident in the paratypes of either sex; it seems possible that these and certain other features such as the strong frontal and interparietal concavities and the extreme thickness and unicarinate condition of the head scales may be heterogonically accentuated in the holotype, which is considerably larger than any of the paratypes, even though the latter are obviously mature. The paratypes



Figs. C-D. *Anolis compressicauda*, UIMNH 35625, holotype. C, scales about one side of body, from middorsal to midventral line, in a strip where laterals are largest, about 2/3 distance posteriorly from axilla to groin. D, lateral view of tail at level of adpressed heel. All drawings by Alice Boatright.

uniformly possess head scales which, in comparison with those of *A. tropidonotus*, are but little less strongly tricarinate, little if any thicker, and which do not exhibit any greater a concavity either in the frontal or in the interparietal area.

It is likely that differences between the two species in color and perhaps in markings of the gular fan are constant. The field notes of Dr. Alvarez del Toro reveal that the dewlap color in the males of *A. compressicauda* is "purplish" in life, without clearly evident dark markings, whereas at least in Chiapan *A. tropidonotus* it is "reddish, with one or two conspicuous, irregular, black streaks or blotches." These observations are borne out by his freshly preserved specimens, in which the dewlap

in the two male *A. compressicauda* is a dull, unmarked, rather dark purplish color, whereas the dewlap in five *A. tropidonotus* is a clear, bright red with the described dark markings brilliantly evident.

Measurements in millimeters of the paratypes, respectively as listed heretofore, are as follows: snout-vent, 45♂, 45.5♀, 42♂, 46♀ with large eggs; head length, 13.2, 12.5, 12.0, 12.0; head width 8.7, 8.7, 8.2, 8.7; tibia 12.2, 11.8, 11.0, 11.3; ear opening, vertical x longitudinal diameters, 2.6 x 1.2, 2.2 x 1.2, 2.4 x 1.2, 2.2 x 1.2.

Comparisons. Reference of *A. compressicauda* to the *tropidonotus* group is required by its possession of elongate, heavily keeled scales not differing greatly in size on the head, heavily keeled and large dorsal and ventral scales on the body, dorsal scales sharply differentiated from laterals and larger than ventrals, narrow digital dilations and a deep axillary pocket.

Comparisons with *A. tropidonotus,* seemingly the closest relative of *A. compressicauda,* are given in the preceding paragraphs. *A. humilis uniformis* is even more like *A. compressicauda* in scutellation than is *A. tropidonotus,* but its smaller body size (not exceeding 38 mm. snout-vent length), dewlap color (bright red with a purplish spot), and less compressed tail readily distinguish it from *A. compressicauda.* No other Mexican or Guatemalan species appear to belong to this group.

Remarks. In the course of determination of the proper name for the species here described, it became necessary to determine the correct allocation of the name *Anolis metallicus* Bocourt. The original description is singularly brief (Ann. Sci. Nat., ser. 5, vol. 17, no. 2, p. 1, 1873), and could apply to almost any member of the *tropidonotus* group. A figure of the dorsal head scales (Bocourt, Miss. Sci., livr. 2, 1873, pl. 17 bis., fig. 1) is the only additional information available on the type. Smith and Taylor (Bull. U.S. Nat. Mus., no. 199, p. 59, 1950) regarded the species as distinct, although Stuart (Occ. Papers, Univ. Mich. Mus. Zool., No. 464, 1942, p. 2) has maintained that it is a synonym of *tropidonotus.*

Through the courtesy of Mr. Jean Guibe, curator of herpetology of the Paris Museum of Natural History, we have had the rare privilege of examining the two cotypes of *A. metallicus* Bocourt, both entered under the number 2890. The larger, an adult female, 48 mm. snout to vent, we designate the lectoholotype. The small lectoparatype measures 27.5 mm. snout to vent.

A. metallicus is, as surmised by Stuart, a synonym of *A. tropidonotus* The lectoholotype, in good condition although a little soft, appears quite typical of *tropidonotus* both in color and in scutellation. The head scales are low, relatively small and tricarinate; ear opening 1.5x0.7 mm.; eye opening 2.4 mm.; head length 12 mm.; tibia 12.5 mm.; dorsal scales (counted forward from midsacral region) 14 to a head length, in 12 longitudinal rows; ventral scales somewhat smaller than dorsals (about 7 in 5 mm., by extrapolation about 17 in one head length); tail round in cross section; sides and venter light in color, dorsum dark except for a series of transverse light bars producing the effect of large blotches on the back. Proportions of head scales essentially as in Bocourt's figure

Digital dilations very narrow but desiccated; 14 lamellae under 2nd and 3rd phalanges of 4th toe.

Anolis crassulus Cope

Eleven specimens (Nos. 34200-3, 34205, 34207-10, 34220, 34222) are from the Región de Soconusco, Chiapas, collected by Eizi Matuda, 1944-1949. The species has not previously been reported from Mexico, although its presence there has been clearly implied by its distribution in Guatemala. The specimens agree well with descriptions of the species. The dorsals are relatively large, generally less than 50 between levels of the axilla and groin, in 10 to 12 series across middle of back, abruptly differentiated from the laterals, and those toward vertebral region a little smaller than paravertebrals; ventrals sharply keeled, about 1½ times as large as dorsals; latter 18-20 in head length, counted along paravertebral line in rear lumbar region, and 38 to 44 in 6 ♀, 40 in 1 ♂, between axilla and groin; loreals in but 4 rows usually, occasionally 5; head scales rugose, often striate, elevated in adults; a deep frontal concavity in adults; supraorbital semicircles sometimes in contact, usually separated by one row of scales; 4 to 7 irregular, enlarged supraoculars, usually 5 or 6, frequently one in contact with supraorbital semicircles; ear opening moderate, about size of interparietal; postanals enlarged in males; maximum snout-vent length 48 mm. in males, 54 mm. in females; tibia about four-fifths snout-ear length.

The females, curiously enough, have a fairly well-defined gular appendage, much more marked than in most female anoles. Four of seven females have a broad, light middorsal line; the other three are unicolor (in preservative) or with a series of large, dim, light rhombs, or ovoids, separated from each other by narrow, dark cross-bands. All the males (4) lack the vertebral stripe, and two appear to have dark cross bands like one female.

Anolis dollfusianus Bocourt

A single juvenile in poor condition (No. 34219) appears to represent this species. It was taken in the Región de Soconusco, Chiapas, by Eizi Matuda, between 1944 and 1949. Its head scales agree perfectly with the figure given by Bocourt (Miss. Sci. Mex., 1873: pl. 16, fig. 19). The ventrals are feebly although distinctly keeled, the preanals smooth; supraorbital semicircles separated by a single row (except at one narrow point) of small scales; a short but broad subocular in contact with supralabials; largest dorsals a little larger than ventrals, very gradually merging with laterals, two middorsal rows slightly larger than others, 53 between axilla and groin levels. Snout-vent length 36 mm.

The species has not previously been reported from Mexico, although its occurrence was to have been expected from its distribution on Pacific slopes in western Guatemala.

Anolis haguei Stuart

A single specimen (No. 34206) from the Región de Soconusco, Chiapas, collected by Mr. Eizi Matuda between 1944 and 1949, constitutes a major problem. It is an adult male in excellent condition, with spread fan; it measures 46 mm. snout to vent, snout to ear 12.6 mm., tibia

10 mm. The scutellation, body form and color are, so far as we can observe, virtually the same as in *crassulus,* except for size of scales on the trunk and limbs. The relative proportions of scales on body and limbs seem the same as in *crassulus,* but the actual size of all is smaller. Objective expressions of size difference may be made in reference to (1) the dorsal nape scales, which are not enlarged anterior to the level of the middle of arm insertions, (2) the dorsal scales between axilla and groin, which count 56 (by least count), and (3) the temporal scales, which count 16 in *haguei* from upper postoculars diagonally posteroventrally to ear, 9 or 10 in *crassulus.* The dewlap is large, reaching to the level of the adpressed elbows; postanals enlarged; enlarged dorsals in some 10 rows but rather irregular in size, some about equal in size to smaller ventrals, others half as long (and considerably smaller in area); dorsal head scales conspicuously convex, rugose but not keeled; a very prominent frontal depression; 5 rows of loreals, but the scales large as in *crassulus.*

We have not seen other examples of *haguei,* but are still satisfied that more than one specimen would be required to secure distinction of a Chiapas population from that of Alta Verapaz. Nevertheless the distribution is highly anomalous at least if *haguei* and *crassulus* are regarded as subspecies. Of course, the presumed occurrence of the two together in Chiapas implies a specific, not subspecific, distinction. Yet the two forms might be regarded as parapatric subspecies even in Chiapas, since precise locality data are lacking, if it were not for the anomalous zoogeographic pattern for subspecies. Taken as species no insurmountable zoogeographic problem exists, as certainly many species exist both in Alta Verapaz and southern Chiapas. If our assumptions are correct that this specimen represents *haguei,* and that the latter represents a species distinct from *crassulus,* then these two merit recognition as sibling species, and certainly *haguei* is to be expected in certain intervening parts of Guatemala.

Of course, the alternatives exist that the specimen here referred to *haguei* either bears incorrect locality data or is simply an anomalous individual. The latter possibility cannot be dismissed, although we regard it unlikely. The former likewise seems improbable, since neither the collector nor any of the subsequent associates have had access to material at least from localities where *haguei* has previously been recorded. It is true that Mr. Matuda collected extensively in Chiapas, and that this specimen could have been obtained in areas geographically nearer Alta Verapaz.

Anolis laeviventris Wiegmann

A single small specimen (No. 34221, 33 mm. snout-vent) in poor condition appears to represent this species. It was taken in the Región de Soconusco, Chiapas, by Mr. Eizi Matuda, between 1944 and 1949. Its head scales agree almost perfectly with the figure given by Bocourt (Miss. Sci. Mex., 1873: pl. 16, fig. 18), except that the supraorbital semicircles are broadly in contact. The dorsals are very small, perhaps two-thirds the size of ventrals, very gradually merging with laterals, which are perhaps one-fourth the size of median dorsals; two middorsal rows slightly larger than others; ventrals distinctly although feebly keeled.

This species has not previously been reported from the state of Chiapas, although it is to have been expected since the species is known from Guatemala, Veracruz and Tabasco.

Anolis lemurinus lemurinus Cope

A single specimen (No. 34211), from the Región de Soconusco, Chiapas, secured by Mr. Eizi Matuda between 1944 and 1949, represents this species. Stuart (in press) has discussed the nomenclature of this race, and recorded its occurrence in Pacific Chiapas, although no precise locality has been recorded.

The present specimen is a nearly full-grown female 56.5 mm. in snout-vent length. The supraorbital semicircles are separated by two rows of narrow scales; dorsals very small, keeled, the two median rows slightly enlarged; largest dorsals about half as long as largest ventrals; latter sharply keeled, 8 in one-third of a head length; snout to ear, 15.2 mm.; tibia 14.2 mm.; pattern typical, with a narrow, light brownish middorsal light streak, and a median dorsal series of large, light-edged rhombs on back and tail.

Anolis milleri Smith

A single specimen (No. 34199) from the Región de Soconusco, Chiapas, secured by Mr. Eizi Matuda between 1944 and 1949, is in the collection. It is referred to *milleri* with some doubt, since that species has been known previously only from Quezaltepec, Oaxaca. The present specimen agrees very closely with the description of the type of *milleri,* however, except in two respects: there is no enlarged scale in the anterolateral corner of the supraorbital area, and the dorsal scales (counted along vertebral line forward from inguinal region) number only 34 (instead of 43).

Snout-vent length, 40.5, tibia 10.5 mm.; snout to ear, 12 mm.; ventral scales quite smooth, 10 to a quarter head length; no enlarged scales among laterals or dorsals; largest dorsals somewhat smaller than ventrals; head scales rugose and with low keels; two rows between supraorbital semicircles; no enlarged postanals (male); interparietal narrow, its greatest length about equal to greatest diameter (1.5 mm.) of nearly round ear; 7 loreal rows.

This specimen may possibly represent an unnamed form, since no names have been applied to examples of this group from areas of Pacific drainage in Chiapas. The differences from *milleri* are sufficient to be interpreted reasonably as reflecting subspecific difference; the very long tibia of *schiedi* (15.5 mm. as compared with a snout-tympanum length of 13.5 mm.) may likewise be taken as at least racially distinctive; *bouvieri* has the supraorbital semicircles in contact; and *cymbops* has the two middorsal scale rows abruptly enlarged. Yet geographic variation in this group is totally unknown, and until it is little may be gained by providing yet another name for the complex. In the meantime the present specimen is tentatively allocated with *milleri* as the most closely similar described form.

Anolis pentaprion Cope

Two adults of this species (USNM No. 136490, UIMNH No.

37066) are from Acacoyagua, Chiapas, collected April 24, 1940, by H. M. and R. B. Smith. A series of 49 hatchlings (UIMNH Nos. 37067-90, USNM Nos. 136491-136516) was taken by the same collectors between July 7 and August 2, 1939, at Palenque, Chiapas. All the hatchlings were obtained from eggs collected in bromelias. Usually four or five eggs were found adhering to each other and to the surface of an inner leaf of a bromelia. Frequently several clutches were found in a single plant. The species was apparently common, yet not a single specimen was seen except for the ones we hatched from eggs. The specimens appear typical, having minute dorsals with two middorsal rows enlarged; smooth, protuberant ventrals; three to four rows of loreal scales, and a medial dorsal row of conspicuously enlarged scales on the tail. This species is now known from both Atlantic and Pacific drainages of Chiapas, and (with synonymy of *beckeri* Boulenger) from Yucatán (Chichen Itza).

Anolis petersi Bocourt

This species has previously been recorded in Mexico from Cuautlapan, Mirador, and Orizaba, in the state of Veracruz, and from Xilitla in San Luis Potosí. Specimens now available are from the additional localities of Ixcuintepec, Oaxaca (No. 36846), between La Gloria and Juchitán, Oaxaca (No. 35485) and "Región de Soconusco," Chiapas (No. 34196). Ten other specimens from localities previously recorded are available. Little geographic variation is evident in this series. The largest measures 135 mm. snout to vent, the tail 311 mm.

Anolis sallaei wellbornae Ahl

Two adult males (Nos. 34194-5) are from the Región de Soconusco, Chiapas, collected by Mr. Eizi Matuda between 1944 and 1949. They possess 54 and 56 dorsals between axilla and groin. Presumably all Pacific coast records in Chiapas for *"ustus"* and *"sericeus"* belong to this subspecies, as defined by Stuart (in press).

With due regard to the considered opinions expressed by several students that both the names *sericeus* and *sallaei* are applicable to the same species, it is our tentative preference to accept the conclusion of Taylor (Univ. Kans. Sci. Bull. 34, 1952, p. 805) that two sympatric species are involved in the complex, embracing some individuals with the supra-orbital semicircles in contact, and others with them separated by as many as three rows of scales. A definitive study of the problem is obviously yet to be made.

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NORTHWARD EXTENSION OF KNOWN RANGE OF THE TAILED FROG, *ASCAPHUS TRUEI* STEJNEGER.—A mature male tailed frog, *Ascaphus truei* Stejneger, was collected at Hovel Bay, north of Orford Bay, on the east side of Bute Inlet, British Columbia, on September 12, 1954, by Mr. F. C. Boyd of the British Columbia Forest Service. The frog was found in a damp creek bottom at an elevation of 2300 feet in a mature hemlock forest. The specimen, now No. 889 in the Provincial Museum collection, measures 42 mm. from tip of snout to base of "tail."

This record extends the known range of the tailed frog some 120 miles northwest of the previously known range limit on the coast (Indian River, near Vancouver, B.C., Carl and Cowan, Copeia, 1945, No. 1, p. 52), and about 30 miles north of the previously known northern latitude in the Fraser Canyon (Slipp and Carl, Copeia, 1943, No. 2, p. 127).—G. Clifford Carl, Provincial Museum, Victoria, British Columbia.

Observations on the Larvae of the Salamander *Eurycea bislineata bislineata*

By ROBERT G. HUDSON

A brief resumé and observations are here presented on the size-distribution, behavior, habitat preference and time of metamorphosis of larval two-lined salamanders, *Eurycea b. bislineata* Green, collected in southeastern Pennsylvania.

The life history of this salamander has been the subject of numerous studies, but our most complete knowledge comes from the investigations of H. H. Wilder, 1899: *Desmognathus fuscus* (Rafinesque) and *Spelerpes bilineatus* (Green). Amer. Nat., 33: 231-246) and I. W. Wilder (1924: The developmental history of *Eurycea bislineata* in western Mass. Copeia, No. 133: 77-80.) These works concerned with salamanders found in Sunderland, Massachusetts, have been the primary sources from which others have drawn to compare or recount the development of the subspecies *bislineata.* Information on the larvae in particular has not been greatly expanded.

The series, consisting of 104 specimens, was assembled during August of 1952 and 1954 in Solebury Township, Bucks County, Pennsylvania. The larvae were collected and observed in springs flowing from monadnocks and in small brooks flowing down the steep fall line between the Piedmont Plateau and Atlantic Coastal Plain. The greatest elevation was approximately 115 feet. Water temperatures of all springs and brooks varied from fifty-eight to sixty-eight degrees Fahrenheit.

Measurements of all the specimens were placed in rank order and thus

size-age groups were ascertained. The smallest specimen in the recently hatched and first year age-group measured 14.2 mm. This indicates that the larva might have hatched in late July or August. The mean total lengths for twenty-eight specimens was 20.3 mm. (see Table 1). They appear to be just beyond the postembryonic period for which I. W. Wilder (op. cit.) recorded an average length of about 14 mm. Bishop (1941, The Salamanders of New York, N.Y. State Mus. Bull., No. 324: 1-365) ". . . two were 12 mm. long and four 12.5 mm." Snout-vent lengths for thirty individuals are given in Table 2. As a result of an examination of the 1952 collections, I had reached tentative conclusions as to the size-age groups to be expected in the future. In 1954 it became apparent that each group was occupying a distinct ecological niche in its environment. Recently hatched larvae were observed to be resting directly below floating leaves or motionless on beds of fine gravel or silt. However, the majority were only seen after the stones under which they were hiding had been removed.

At the apparent end of the second larval year, fifty specimens had reached a mean total length of 41.6 mm.(see Table 2 for snout-vent lengths). I. W. Wilder (*bid.*) has recorded an average length for this group of 33 mm., ". . . although they show a large range of variation in size." Members of this group probably complete their metamorphosis during late August or September. The frequency with which individuals of this size were encountered becomes apparent when compared with the numbers collected in the other groups. They were less secretive, seldom found hiding under objects and rather active in water three to five inches deep. In pools one to two feet in depth they were observed walking on the sand bed; others were resting on the stream bed, rocks, or sunken objects. On the bottom of one small pool, eight larvae were grouped at the inlet, as if waiting for food to be carried downstream by the water current.

A unique aspect of the larval development of *bislineata* is the occurrence of laggard specimens which do not metamorphose until the end of their third year. Great care has been taken to segregate these individuals, and only those of near maximum size and showing no signs of gill deterioration were placed in this size-age group. They appear to be definite exceptions, for only thirteen were collected. They had a mean total length of 56.9 mm. Of the thirteen specimens studied, there is little increase in snout-vent length, but rather an increased tail growth, manifested in a larger mean total length (see Table 1 and Table 2 for the marked dichotomy between measurements of the second and third year groups). Invariably such specimens were found secreted under stones along the water's edge. Time and again their agility and rapidity in eluding the collecting net proved frustrating. The most successful method of collecting was to locate a specimen, place the net behind it, lightly touch it with a twig, and thus attempt a forced retreat into the net. Others were secured by placing the net in a small riffle of water, turning over all the stones in front of it for a distance of several feet, and letting the dislodged larvae be washed into the net.

No deliberate attempt was made to collect the adult form. However, in 1954 the following observations were made. There was an extended drought in the study area which resulted in such a decrease of the water

supply that many streams dried up or had their flow greatly reduced. The ground adjacent to the streams, which usually harbored adult *bislineata,* became practically uninhabitable due to lack of moisture. It was found that some adults returned to the immediate vicinity of water, others were found in the moist earth under the larger stones, and one specimen was secured from the center of a large rotten log at stream side. Several recently transformed specimens have snout-vent lengths approximately equal to the largest second year larvae and the third year group (see Table 2). The largest individual has a total length of 60.9 mm., but this does not approach the 68.6 mm. size of the largest larvae with well-developed gills.

TABLE I

Total lengths (in mm.) of 88 larval *Eurycea bislineata bislineata* from southeastern Pennsylvania.

Age	N	Range	Mean	$S.D._m$	S.D.
1[1]	28	14.2-25.3	20.3	± .54	2.85
2	50	31.0-48.7	41.6	± .58	4.12
3	10	46.7-68.6	56.9	±1.93	6.09
T[2]	5	54.6-60.9	57.6	±1.10	2.45

TABLE II

Snout-vent lengths (in mm.) of 97 larval *Eurycea bislineata bislineata* from southeastern Pennsylvania.

Age	N	Range	Mean	$S.D._m$	S.D.
1[1]	30	9.2-15.7	12.5	± .30	1.62
2	54	18.1-27.0	23.8	± .24	1.81
3	13	27.2-34.2	29.5	± .56	2.03
T[2]	7	27.1-34.1	29.6	± .84	2.22

[1]This age group includes specimens that appear recently hatched and those of approximately one year.

[2]These specimens did not have functional gills or were lacking gills entirely, and are considered transformed.

The statistical measures of variability here used are as follows:
$S.D._m$ equals the standard deviation for the sample divided by the square root of the number of cases in the sample.

S.D. equals the square root of the sum of the squared individual variations from the mean divided by the number of cases.

ACKNOWLEDGMENTS

I am indebted to Mr. Pat Menichini of the Philadelphia Zoological Garden for assistance in field work. Mr. Roger Conant of the Philadelphia Zoological Garden, Mr. John T. Wood of the University of Virginia, and Mr. Neil D. Richmond of the Carnegie Museum, read the manuscript and offered many helpful suggestions. To these persons I extend my appreciation.

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Notes on the Ecology of the Oak Toad in Florida

By W. J. HAMILTON, JR.

The oak toad, *Bufo quercicus* Holbrook, occurs from North Carolina to Louisiana. It is extraordinarily abundant in much of its range, notably in peninsular Florida. In spite of this abundance, little has been recorded on its habits other than the mode of reproduction. Field studies, made intermittently from 1939 to 1954 in the area of Fort Myers, Lee County, and Orlando, Orange County, Florida, have resulted in the accumulation of some data on this species, the most diminutive of all bufonids. This toad mite, when fully adult, scarcely exceeds an inch in length, although females may occasionally approximate 1-3/16 in. (30 mm.) or more. The extraordinary abundance of this species in peninsular Florida, combined with its diurnal activity, presents no end of opportunities for study. By direct observation, much can be learned of its mode of life, quite the contrary of most bufonids that wait on darkness to forage. Much of the recorded information on this small toad has been secured only during the season of reproduction, when their bleating calls give evidence of breeding congregations. Carr (1940, Univ. Fla. Publ. Biol., Sci. Ser., 3: 1-118) indicates that the toad is largely diurnal and may be found "hopping about in the daytime throughout the year. . . . In cold weather I have found them in rotten oak logs and under pine bark." Carr believes that, during the breeding season, it would be possible to cross central Florida by car and at no time be in a situation where the calls of *quercicus* were not audible.

Our observations are not concerned with the season of reproduction; this phase of the life cycle has been well recorded and documented by Wright (1931, Frogs of Okefinokee Swamp). Rather, it concerns the behavior of the toad at a time other than the breeding period.

Numbers. The incredible populations of this tiny amphibian in certain areas of Florida are recorded in our field notes. A few examples will suffice. My son and I collected along a dry ditch bordering a sandy road seven miles south of Orlando, Florida. This was an area of burnt over cabbage palm. On April 3, 1947, between 4-5 p.m., 49 toads were taken in an area approximating 27,000 square feet. In this area, at the time, we judged there were 70 toads to the acre. Two days later, under similar weather conditions, only two toads were collected. The area, presumably in time, would be repopulated with oak toads. An adjoining area with similar cover, provided fewer toads.

From February 21, 1954, to March 22, 1954, an area of approximately one acre was selected for a home range study of this species. The study area was a mile north of the Edison Bridge, Fort Myers, Lee County, Florida. Sandy soil had been exposed by the burning of cabbage palm, the charred roots and trunks giving refuge to *Bufo quercicus,* a few *Bufo terrestris, Acris gryllus* and skinks. Ground cover was abundant, in the form of numerous grasses and small flowering plants. This area was covered rather thoroughly every other day, captured toads being marked, and individuals recovered for a study of their movements. In

the period of observation, it is judged that 70 or more toads occupied this area. Four miles south of Fort Myers (U.S. Route 41) on the left side of the road, a similar area of approximately an acre produced no toads.

Home Range. On February 21, 1954, in the area north of Fort Myers described in the preceding paragraph, the home range of the marked toads was studied. In this area of loose, friable sandy loam, the oak toad utilized the mats of grass and ground debris and apparently burrowed little. Approximately half of the area was open and afforded the collector a clear view of the ground surface. On this site, an acre was marked off on one end of the tract, its eastern edge marked by dense vegetation that bordered a hyacinth-choked stream. The boundaries to the north, south and west were contiguous with habitat similar to that of the marked plot.

On the initial date, 26 toads were marked by incising one or a combination of two toes. Not more than one toe was removed from a foot. These individuals, as others subsequently marked, were measured from snout to vent. When measuring, the toad was held either by a front or hind limb. Each individual was measured three times, and the average of the three measurements recorded as the snout-vent length. The 26 toads averaged 19.4 mm., with extremes of 17.5 to 23 mm. The area, roughly square in outline, was traversed slowly along one side, then down through the middle of the quadrat and up the other side. As a toad was collected, marked and released at the site of capture, a numbered stake corresponding with the marked toad, was placed in the ground. On succeeding days, as others were marked and released, additional numbered stakes marked their point of capture. Eventually 40 toads, distributed over the area, were marked. Eighty-four additional individuals were collected from the quadrat and preserved for future study. The area was visited daily until March 22, a final survey being made on April 10.

More than a single recovery was made of eleven marked toads, two being recovered five times. The ratio of marked to unmarked toads in the area indicated little fluctuation or movement into or out of the quadrat, except at its periphery. In all instances, marked toads were released at the site of their recovery. A few records of the movement of marked animals are recorded below.

No. 1. Marked on February 21, this toad was recovered three feet east of the point of capture on February 27. It was retaken 33 feet north of the original point of capture on March 13.

No. 2. This toad was marked on February 21, recaptured on March 2 and 12. It was retaken within three feet of the original point of capture on both occasions.

No. 5. A toad marked on February 21 was recaptured March 21 within a foot of its original capture.

No. 12. Marked on February 21, this individual was retaken on March 13 seven feet from the original site of capture.

No. 17. First marked on February 21, this toad was taken 88 feet north of the point of initial capture on March 18.

No. 21. A toad marked on February 21, was recaptured eight feet from its initial station on March 14. The following day is was taken a yard from the site of the previous day's capture.

No. 22. From February 21 to March 18, this individual was recovered five times, all within an area of 220 square feet.

No. 24. First taken on February 21, the toad was taken four times in the following month. All recaptures were within 16 feet of the original site. When finally taken on April 10, this individual was recovered seven feet from the point of capture on February 21.

No. 35. Initially taken on March 2, this toad was recaptured 8 feet from the original site on April 10.

Growth. In a population of toads, particularly during the non-breeding season, it is impossible to assess age classes merely by assigning arbitrary ages to groups that fall in several presumed size classes (Hamilton, Copeia, 1934: 88-90). Growth can be determined only by marking, measuring and releasing individuals and recapturing them as opportunity affords. To be sure, the size limits of oak toad populations in the late winter, early spring, and the fall, vary markedly. A few examples are presented. These indicate the average and extreme measurements (snout-vent) of oak toad populations at specific localities on the same date.

Locality	Date	No.	Males	Females
Ga.: Charlton Co.	July 3, 1922	17	25.3(24-27)	———
Fla.: Lee Co.	Mar. 18, 1942	63	20—18.3(17-21.5)	43—20.3(17.5-25)
Fla.: Lee Co.	Mar. 1-15, 1954	20	5—17.6(16-20)	15—18.9(17-24)
Fla.: Collier Co.	Mar. 27, 1949	14	9—18.4(15-23)	5—20(17-24)

A few stunted individuals may occur in a population that ranges between 17-22 mm. Witness the 11 mm. individual collected at Orlando, Florida, in March, 1947. We meet with the same situation in studies of *Bufo terrestris americanus* in New York, where diminutive toads (11-13 mm.) are sometimes found in late summer populations of toads (from 2-3 months old) thtat average 25-27 mm. in length.

Growth is rather rapid, and appears to be similar to that recorded for *Bufo terrestris americanus* (Hamilton, *loc. cit.*). As examples of growth rate, the following data are provided.

1. A 17 mm. toad taken on February 21 was retaken on March 20, at which time it measured 21 mm.

2. An 18 mm. individual collected on February 24 was recaptured on March 17. It had increased 3 mm. in body length during the three week period.

3. A 22 mm. toad collected on February 22 was recaptured on March 26. It measured 24 mm., a gain of two millimeters in little more than a month.

4. An 18 mm. toad collected on February 24 was recaptured four times; when last taken on April 10 it measured 22 mm.

Other individuals show a corresponding rapid rate of growth, averaging an increment of from 2-4 mm. a month during the late winter and early spring.

The transformation size approximates 7-8 mm. (Wright, *op. cit.*),

while large breeding males average 25-26 mm. and females may approximate 30 mm. or slightly more. In the region of Orlando and Fort Myers, Florida, these toads are not active in late December and January. A thorough search for toads at this season has been unproductive. One may assume the growing season in the Florida peninsula to occupy nine months, perhaps less. Cold winds and chilly days of March and April, even an overcast sky, results in marked reduction of activity. This lessens the movements, and hence feeding activity, tending to lessen food intake and consequent growth.

In considering the long period of activity, and the almost invariably well-filled stomachs of the two hundred toads examined for food, combined with the growth rate as observed in the field, one must conclude the growth is reasonably rapid. It is probable, from the available data at hand, that the males of *Bufo quercicus* may become sexually mature following the year in which they transform. Females probably mature in their second year. The life span is problematical, but presumably does not occupy more than two or three years. If adults survive after the spawning season, one should find some 25-30 mm. individuals in the late fall and late winter following the season in which they breed. We have not collected individuals more than 24 mm. in length other than during the spawning period (April through September).

Food. Due largely to its abundance, the oak toad is possibly a more important predator of small invertebrates than the larger *Bufo terrestris* which often occupies the same habitat. Several small *terrestris* were taken in daylight hours when marking studies of the oak toad were in progress. All toads, so far as our present knowledge of their dietary is concerned, feed primarily upon invertebrates. The food of 86 *Bufo quercicus* from Florida truck gardens in the vicinity of Orlando and Fort Myers has been briefly summarized (Hamilton, 1954, Herpetologica, 10: 37-40).

Two hundred oak toads have been examined for food. These represent a few Georgia specimens; the majority were taken in Florida. The purpose of toad food analyses was to establish, if possible, the role of this small toad in reducing insect pests of cultivated plants. More important, it was our wish to determine the nature of the food and compare it with juveniles of New York *Bufo terrestris americanus* of comparable size. In brief, the food of the two is essentially the same.

The results were anticipated after a few dozen toads were examined. The primary food consists of ants. This food is a reflection of the extraordinary abundance of formicids in the range of *Bufo quercicus.* Ants, possibly the world over, are the principal food of toads, largely due to their great abundance. The more important species eaten by this toad include *Brachymyromex depilis, Dorymyomex pyramicus, Odontomachus haematoda, Solenopsis globularia, Pheidole floridana* and *Iridomyrmex pruinosus.* Often three or more species of ants occurred in a single stomach, the small species constituting the bulk of the food. The importance of formicids in the dietary is reflected in the high incidence of

these insects. Ninety-four per cent of the 200 toads examined contained ants. Some stomachs contained more than 200 head capsules of the smaller species.

Beetles are the second most important prey species, occurring in 67 per cent of the toads that were examined. The principal families that were eaten include the Carabidae (*Seleniphorous, Dyschrius, Tachyura*), Staphylinidae, Pselaphidae, Histeridae, Cleridae, Elateridae, Heteroceridae, Nitidulidae, Coccinellidae, Tenebrionidae and Scarabeidae. Several stomachs contained four to six weevils, *Hyperodes minimus,* tremendously distending the stomach.

Other foods, in the order of frequency, include spiders, mites, hemipterans, aphids, lepidoptera larvae, molluscs, dipterans, orthopterans, millipedes, centipedes, collembola and pseudoscorpions.

Most of the stomachs contained the usual adventitious material: particles of loose bark, sand, weed seeds and dirt that adhere to the viscid tongue as the toad captures its prey.

The amount of food eaten must be prodigious; practically all stomachs were well distended. Five toads with well filled stomachs had a volume of 5 cc. The stomach contents of these five totaled 1.5 cc. Thus the average stomach contents of these five individuals approximated nearly a third the bulk of the toad.

Availability presumably determines the food eaten at any given time and locality. From February 22 to March 10, 1954, at Fort Myers, Florida, 11 of 30 toads contained negro bugs (*Thyreocorinae*) and 12 of the same lot had eaten the weevil, *Hyperodes.* These insects occupied the larger bulk of the food eaten during this period, although ants far outnumbered them in individual stomachs. Results of the stomach analysis are presented in Table 1.

Table 1. Food of 200 *Bufo quercicus* collected in Georgia and Florida (February-September).

Food	*Frequency of Occurrence*	*Food*	*Frequency of Occurrence*
Ants	94.0	Molluscs	10.0
Beetles	67.0	Diptera (adults)	6.0
Spiders	17.0	Orthoptera	6.0
Mites	16.0	Pseudoscorpions	4.0
Hemiptera	14.0	Collembola	2.0
Aphids	14.0	Millipedes	2.0
Lepidoptera (larva)	10.0	Centipedes	1.0

Parasites. Nematodes occurred in 13 of the 200 animals examined for food. These include *Oxysomatium variablis,* which is encapsulated on the outer stomach lining, and *Oswaldocruzia subauricularis,* occurring within the stomach lining and in the middle part of the length of the intestine. The nematodes were determined by Mrs. M. B. Chitwood.

Dr. Henry Dietrich determined thte beetles. Nellie Hamilton and our children contributed materially to the collecting of specimens.

SUMMARY

The oak toad is the most conspicuous amphibian of peninsular Florida. Its diurnal activity provides a source of observation quite contrary to most bufonids. Some populations may approximate 80 to an acre in the non-breeding period; comparable areas may produce only two or three individuals. Home range is restricted, most toads in the late winter or early spring occupying only a few square rods for their foraging. Growth is rapid, an increment of 2-4 mm. in body length may take only a month in late winter. Food consists primarily of ants and beetles. The intake is prodigious, since some toads contain food approximating a third of the weight of the individual. The oak toad, due to its abundance and diurnal activity, is a species worthy of further study.

DEPARTMENT OF CONSERVATION, CORNELL UNIVERSITY, ITHACA, NEW YORK

PROLONGED SURVIVAL OF A RELEASED ALLIGATOR IN PENNSYLVANIA.—The remarkable survival of a released alligator through six or seven Pennsylvania winters has been brought to my attention by David McNary, D.V.M., of Castle Shannon, Allegheny County, Pennsylvania. While it is regrettable that more exact dates could not be ascertained, it is verified that a pet alligator measuring "nearly a foot and a half" was released in a local marshy area during the summer of 1942 or 1943. An alligator was frequently seen in the marsh through the next several years, and its presence there became a matter of common knowledge among local residents. During the spring of 1949, a highway construction crew was engaged in building a roadway over the marsh. Several times the men were startled by suddenly encountering an alligator, until the foreman of the crew had a local peace officer shoot the animal. Dr. McNary, who was then veterinarian at the Highland Park Zoological Gardens in Pittsburgh, Pennsylvania, examined the carcass, found it to measure "nearly five feet," and identified the reptile as an American alligator, *Alligator mississippiensis* Daudin. While there is no way to establish definitely that the alligator killed in 1949 was the one released in 1942 or 1943, the circumstances strongly suggest that this is the case.

Meteorological data (Rockwood, Henry. 1952. *Local Climatological Summary with Comparative data, 1951, Pittsburgh, Pennsylvania.* U. S. Dept. Commerce, Weather Bureau. Chattanooga.) recorded by the weather station at the Allegheny County Airport, five air miles from Castle Shannon, shows that for the seven-year period from 1942 to 1949 the mean temperature (in degrees Fahrenheit) for the coldest month varied from 21.7 to 35.2 (av. 26.5); the mean temperature of the coldest four months varied from 31 to 37.9 (av. 32.9); and the days below zero from 0 to 4 (av. 2.4). Thus it is noted that the mean temperature reading for one third of each year survived by the alligator hovered around the freezing point. Since the American alligator is known to hibernate in the northern extremes of its normal range, it may be presumed that this physiological device preserved the life of the individual in question through winters of a length and severity far beyond those normally experienced by this species.—A. J. Barton, The Stony Brook School, Stony Brook, Long Island, N. Y.

THE TADPOLE OF *BUFO DEBILIS DEBILIS*.—Smith, Amer. Midl. Nat., 15: 445-6, pl. 12, fig. 8 (1934) published a description of a tadpole of unknown parentage with the reasonable inference that its species was *Bufo debilis* Girard. Confirmation has long been needed.

On June 21, 1955, while on a collecting trip to southwestern Oklahome for the Oklahoma Biological Survey, I investigated a small cattle tank west of and adjacent to Oklahoma Highway 34, 3.6 miles north of Duke, Jackson County. In a long ditch-like pool which had been cut off from the main pond, I collected a few tadpoles not recognized immediately although quite obviously of Bufo. Some were in late premetamorphic stages, others with hind legs well enlarged and still others with all four legs present and the tail reduced. In the weeds on the mudflat immediately adjacent, recently transformed toads of two species were abundant. The majority of these were *Bufo compactilis speciosus* Baird. The others were *B. d. debilis*. Obviously both species had bred here and most if not all of the tadpoles of the former had transformed whereas probably not all of the latter had done so. The unrecognized tadpoles, therefore, almost certainly were the long-sought larvae of *B. d. debilis*, especially since I could find none of *B. c. speciosus* with which I am quite familiar. Hylid tadpoles (probably *Pseudacris clarki*, although not examined carefully) were also present.

Twelve Bufo tadpoles were secured and preserved immediately in approximately 5% formalin. Examined later in the laboratory, these conformed in color, proportions, shape of jaws, and general appearance to those described by Smith. However, there were some differences as follows: (1) the labial formula was 2/2, there being no signs of the third ventral row of denticles as figured by him and expected in tadpoles of Bufo; (2) the lower row of denticles on the dorsal labium was widely divided in the middle in all specimens with still apparently perfect mouth parts (seven of the twelve); (3) no transparent ventral stripe was evident in the preserved animals. (I neglected to look for it in the live ones where Smith says it is "very conspicuous.")

It is barely possible that all of these tadpoles had lost the third ventral row of denticles prior to or because of preservation. I think this quite unlikely because (1) all seemed firm and well preserved, and (2) some of the older ones had lost parts of several rows of teeth and these had been removed in a haphazard manner; why should only all seven of the younger ones have lost completely the whole third row, the other rows remaining perfect?

All of the tadpoles in mid-to-late metamorphic stages had acquired dorsal spotting, peppered with tiny raised pimplings, suggestive of the adult condition. There was in the series also an unmistakable transition from these older tadpoles to the recently transformed *B. d. debilis* on the bank of the pool.

The differences in the mouth parts of these tadpoles as compared to those described by Smith may be explained in either of two ways: perhaps (1) Smith's tadpoles were of *Bufo debilis insidior*, a subspecies not generally recognized when Smith published, or (2) tadpoles of *B. d. debilis* in southern Kansas differ from those of the same form in southwestern Oklahoma because of either (a) evolutionary divergence or, more likely, differences in environment. The latter seems clearly the better

hypothesis since *B. d. insidior,* as now understood, is not to be expected as far east as Comanche County, Kansas (Sanders and Smith, 1951, Field and Lab., 19: 141-160; Savage, Texas Journ. Sci., 6: 83-112), where Smith's tadpoles were collected.

I conclude, therefore, (1) that Smith's tadpoles represent *B. debilis debilis,* (2) that mine also, (3) that the differences between the two lots are most likely due to differences in the environment, and (4) that further observations are needed to determine the extent of variations in this subspecies. It will well repay anyone, also, to compare these tadpoles with those of *B. d. insidior* when these can be found: they are at present entirely unknown.—Arthur N. Bragg, University of Oklahoma, Norman, Oklahoma.

A NORTHWARD RANGE EXTENSION FOR *BUFO CANORUS* CAMP.—The north-south distribution of the Yosemite toad, *Bufo canorus,* has most recently been designated (Stebbins: Amphibians of Western North America, 1951) as extending from Sonora Pass, Alpine County, in the north, to near Kaiser Pass, Fresno County, California, in the south. Actually, the Sonora Pass locality is in Tuolumne County. This particular site was found by Dr. T. I. Storer on July 16, 1930, in Deadman Creek Canyon near "Dead Man's Grave" (Storer: Personal field notes, Book No. 6, pp. 1305-1310, July 15 and 16, 1930). Wiggins (Copeia, 1943 (3) 197) cites a collection from the same general area of Tuolomne County, but does not specify the locality in sufficient detail to determine the exact location. So far as can be ascertained, no other more northerly locality has been subsequently recorded.

On August 11, 1952, numerous larvae and newly metamorphosed juveniles of *B. canorus* were found in a small meadow in the upper end of Hermit Valley, Alpine County, California. The exact locality is 1.5 miles airline south of Ebbett's Pass, and extends the known range approximately 18 miles airline northwest of the Sonora Pass area. By road the meadow is 2.4 miles south of State Highway No. 4 on the Highland Lakes road. The elevation of the site is 7,800 feet. Twelve larvae were collected from a small stream two inches deep by 12 inches wide and a pond 6' x 15' x 12" deep. Fifteen juveniles were collected from cattle hoof prints in various parts of the damp meadow 25 to 150 feet from the stream. Drainage from Hermit Valley is into the Mokelumne River. Larvae were found again in the same place on June 27, 1954; on July 11, 1954, two more juveniles were collected that were 24 mm. and 31 mm. in snout-vent length.

On July 11, 1954, the species was found at South Highland Lake at the 8,700 foot elevation. Here an adult male of 61 mm. snout-vent length and a female of 51 mm. snout-vent length were found at opposite edges of a small snow-melt pond at the south edge of the lake. A juvenile 20 mm. in snout-vent length was found in the grass nearby. This locality is approximately 4.5 miles airline south of Ebbett's Pass. South Highland Lake is at the headwaters of Highland Creek which flows into the North Fork of the Stanislaus River.—R. L. Livezey, Sacramento State College, Sacramento, California.

Thermo-Regulation in the Musk Turtle, *Sternotherus odoratus* Latreille

By RICHARD A. EDGREN and MARGERY K. EDGREN

The maintenance of body temperatures within narrow vital limits is accomplished by endogenous metabolic mechanisms in birds and mammals. The vast majority of animals, including the reptiles, however, lack endogenous mechanisms and control body temperatures through behavioral activities. In this regard the reptiles of xerothermic areas have been studied particularly (Bogert, 1949; Cowles and Bogert, 1944). The dramatic results obtained by herpetologists working in desert areas has tended to concentrate such studies among the southwestern workers, leaving unfortunately neglected the northeastern fauna. An exception is Carpenter's recent (1955) abstract giving body temperatures of three species of garter snakes. The present communication concerns a field and laboratory study of thermo-regulation in the musk turtle, an almost completely aquatic form (Carr, 1952) which is thus adapted to a more stable environment than the terrestrial forms previously studied.

MATERIALS AND METHODS

Cloacal temperatures were taken in the field with a Schultheis quick reading thermometer (Bogert, 1949). The turtles were collected from shallow water of Rockland Lake, 1½ miles east of Burlington, Racine County, Wisconsin. Our method was to walk among the rushes along the shore, scanning the bottom for turtles, turning boards and other cover and searching by hand through masses of dead vegetation. When a turtle was located, a small plastic cigarette case was submerged in the water, open end down, to a position immediately next to the turtle. The cigarette case was then inverted and allowed to fill with water and the turtle seized with the same hand. The cloacal temperature was taken immediately, one of us handling turtle and thermometer while the other grasped the tail of the turtle. The turtle was sexed during this period. After the cloacal temperature had been recorded, the cigarette case was removed from the lake and the temperature of the water contained was recorded as the environmental temperature.

In the laboratory, four turtles [the single male collected on the last trip (Table I) and three females obtained through the kindness of the authorities of Camp MacLean on Rockland Lake] were placed in individual 1500 cc. beakers with about 500 cc. of tap water added. The beakers were allowed to come to equilibrium with laboratory temperatures and then temperatures were taken of both turtle and water in the beakers. The same procedure was repeated with the beakers placed in a cold room (5°C) and immersed in a constant temperature bath (33.6°C). In the case of the cold room and the temperature bath, the turtles were allowed about 50 minutes to approach equilibrium. Statistical methods have been adapted from Snedecor (1946) and Bliss and Calhoun (1955).

RESULTS

Field Studies. Dates of collection, cloacal and environmental temperatures, and sex on all turtles are shown in Table I. From these data one may generalize that at lower temperatures the turtles tend to be warmer than their environment, whereas at higher temperatures they are somewhat colder. This is also indicated by the slope of the least squares regression of cloacal upon environmental temperature which was estimated as 0.87 ± 0.0298 (Fig. 1).

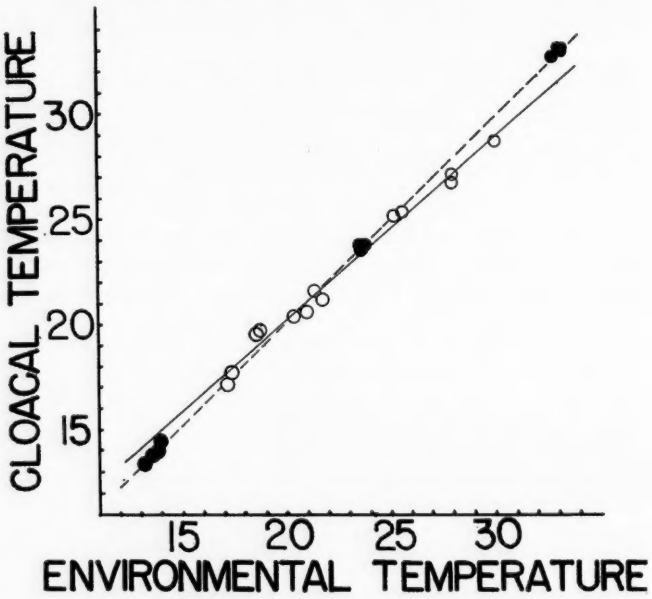

Figure 1. Relation of cloacal to environmental temperatures in *Sternotherus odoratus*. Solid circles, laboratory results; hollow circles, field results. Regressions of cloacal on environmental temperatures:
Laboratory (dotted line): $y = 0.58 + 0.98x$
Field (solid line): $y = 2.79 + 0.87x$

Laboratory Studies. Under the conditions imposed in the laboratory, cloacal and water temperatures paralleled each other closely (Table 2). Again this was confirmed by the slope of the regression (a least squares line was fit to the three points located by the cloaca-environmental mean temperatures). In this case the slope was estimated at 0.98 ± 0.0073, which does not differ significantly from a slope of 1 ($t = 2.747$, d.f. $= 1$,

$p > 0.05$). However it does differ significantly from the slope of the curve obtained in the field ($t = 3.583$, d.f. $= 12$, $p < 0.01$).

This same problem can also be attacked from a second point of view. The deviations of cloacal temperatures from temperatures of the water in the beakers was calculated. The mean deviation was 0.3 ± 0.01°C. for cold room animals. A comparison of this deviation to the deviation of 0 expected with no thermal control shows that the turtles were significantly warmer than the water ($t = 30.0$, d.f. $= 3$, 0.001).

TABLE I

Temperature data on *Sternotherus odoratus* collected in Rockland Lake, Racine County, Wisconsin.

Turtle Number	Date of Capture	Cloacal Temperature	Environmental Temperature	Sex
1	30/iv/55	18.6	—	♀
2	"	18.2	—	♀
3	"	18.2	—	♀
4	"	19.6	18.6	♀
5	"	19.8	18.8	♀
6	"	17.2	17.2	♀
7	"	17.8	17.4	♀
8	30/v/55	21.6	21.4	♀
9	"	20.6	21.0	♀
10	"	20.4	20.4	♀
11	"	21.2	21.8	♀
12	18/vi/55	27.2	28.0	♂
13	"	26.8	28.0	♀
14	"	25.4	25.6	♂
15	"	25.2	25.2	♀
16	16/viii/55	28.8	30.0	♂

TABLE II

Cloacal and environmental temperatures of *Sternotherus odoratus* confined in beakers at various laboratory temperatures.

Turtle		Cold Room		Room Temperature		Water Bath	
Number	Sex	Water	Cloaca	Water	Cloaca	Water	Cloaca
1	♂	13.6	13.8	23.8	23.8	33.2	33.2
2	♀	13.2	13.4	23.8	23.8	32.8	32.8
3	♀	13.8	14.0	23.6	23.8	33.0	33.2
4	♀	14.0	14.6	23.6	23.6	33.2	33.0
Mean		13.65	13.95	23.70	23.75	33.05	33.05

DISCUSSION

In the field, musk turtles were apparently able to control body temperatures to some extent, presumably by employing behavioral mechanisms, and perhaps by physiological mechanisms under certain circumstances. The absolute temperature values obtained showed that at the lower environmental temperatures the turtles were warmer than the water, whereas at higher temperatures the turtles were cooler. Carpenter (1955) has reported similar temperature relationships in three species of *Tham-*

nophis. The sharp depression of the slope of the least squares regression from the slope of 1 which would be expected from a body with no thermo-regulation implied that the turtles utilized some mechanism of thermal control. In the laboratory, this ability to control temperature appeared to be largely lost, the slope of the regression closely approximating unity under these conditions. At the higher and moderate laboratory levels, no deviations from environmental temperatures were indicated by the data. However, at the lower end of the curve, cloacal temperatures were increased. This may have resulted from a lag of change of turtle temperature from change of water temperature or perhaps from some slight endogenous thermo-regulation (metabolic heat?). In the laboratory, the turtles were confined in beakers which greatly decreased the potential amount of movement and completely inhibited the possibility of selection of cooler or warmer areas. How this behavioral thermo-regulation might be accomplished remains in doubt. Musk turtles are, in addition to being highly aquatic, highly nocturnal (Carr, 1952; Edgren, 1944), and most foraging and movement takes place at night. All of our collecting was done during the day when movement was least, and most of our turtles were quiescent when captured; however we must assume that the turtles were sufficiently active to maintain the temperatures obtained. In this regard, the data of Table I show that as the season progressed and the water warmed, the numbers of turtles captured decreased, suggesting, perhaps, that the turtles had moved to deeper, cooler water (one additional turtle was captured on the first trip, but its temperature was not taken). It must be added here, however, that Camp MacLean on Rockland Lake had opened between the first and second trips and the heavy influx of young boys (most of whom are turtle hunters) may as well account for the decrease in population.

SUMMARY

Under field conditions, temperatures of the musk turtle, *Sternotherus odoratus*, were found to be higher than the water temperature when water temperatures were low (17-19°C) and lower when water temperatures were high (28-30°C). In the laboratory, cloacal and water temperatures were about the same, suggesting that thermo-regulation resulted from behavioral mechanisms precluded by laboratory conditions. At the lower level of temperatures in the laboratory, the turtles were slightly, but significantly, warmer than the water, suggesting the possibility of a slight endogenous thermo-regulation.

ACKNOWLEDGEMENTS

We are indebted to the authorities of Camp MacLean for allowing us to collect on their property and for supplying specimens when our own efforts were unsuccessful.

LITERATURE CITED

Bliss, C. I., and D. W. Calhoun. 1954. An outline of biometry. Yale Co-op. Corp., New Haven.

Bogert, C. M. 1949. Thermoregulation in reptiles—a factor in evolution. Evolution, 3(3): 195-211.

Carpenter, C. C. 1955. Body temperatures of three species of *Thamnophis*. Bull. Ecol. Soc. Amer., 36(3): 74.

Carr, A. F., Jr. 1952. Handbook of turtles. Comstock Publishing Associates, Ithaca, N.Y.

Cowles, R. B., and C. M. Bogert. 1944. A preliminary study of the thermal requirements of desert reptiles. Bull. Amer. Mus. Nat. Hist., 83(5): 261-296.

Edgren, R. A. 1944. Notes on amphibians and reptiles from Wisconsin. Amer. Midland Nat., 32: 495-498.

Snedecor, C. D. 1946. Statistical methods. 4th ed. Iowa State College Press, Ames.

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Arboreal Habits of Certain Reptiles and Amphibians in Southern California

By JOHN D. CUNNINGHAM

Relatively little has been reported on the arboreal tendencies of the reptiles and amphibians of western North America. While no species in the area studied can be regarded as truly arboreal, the observations herein reported possibly tend to show a somewhat wider use of the arboreal habitat than has been previously appreciated. Although arid regions are not generally regarded as ideal for arboreal species, there are numerous intrinsic factors of those areas that actually do favor climbing behavior.

Norris (1948, Herpetologica, 4: 217-218), Warren (1953, Herpetologica, 9: 121-124), and Cowles (Copeia, 1946: 172-173) observed *Callisaurus d. gabbi, Chionactis o. occipitalis* and *Dipsosaurus d. dorsalis*, respectively, in creosote bushes (*Larrea divaricata*). Cowles and Bogert (1936, Herpetologica, 1: 33-42) record finding 72 *Urosaurus graciosus* in creosote bushes during one evening's collecting. Van Denburgh (1922, Occ. Pap. Calif. Acad. Sci., 10: 1-1028) reports, among others, upon use of the arboreal habitat by *Crotalus ruber, Lampropeltis g. californae* and *Coluber c. mormon*. Hoffmeister (1951, Herpetologica, 7: 146) records finding *Urosaurus ornatus* on barbed wire fences at night in southeastern Arizona. The arboreal habits of the snakes *Opheodrys vernalis* and *Oxybelis aeneus* are well known. Oliver (1951, Amer. Nat., 85: 171-176) gives an interesting account of "gliding" in several species of reptiles and amphibians.

The writer wishes to thank Dr. Raymond B. Cowles and Mr. Don P. Mullally for their aid in this study.

Batrachoseps a. attenuatus (Eschscholtz). Although primarily found under surface objects on damp soil and in leaf litter, *Batrachoseps* is not infrequently found as high as seven feet above the ground between the loose bark and trunk of dead live oaks (*Quercus agrifolia*). Obviously, because of the salamander's moisture requirements, only in a limited number of trees can they be thus discovered. This climbing proclivity is especially striking during or immediately following the early fall rains, when these salamanders emerge in great numbers from their subterranean summer retreats.

Elgaria multicarinata webbi (Baird). Alligator lizards are frequently captured in trees and shrubs (Grinnell and Grinnell, 1907, Throop Inst. Bull., 35: 1-64). In the San Bernardino Mountains they have been observed a number of times lying on the flat sprays of the white fir (*Abies concolor*) or climbing in the low branches of yellow pine (*Pinus ponderosa*) and incense cedar (*Libocedrus decurrens*). In city gardens this lizard is commonly seen in vines and shrubs and on one occasion the writer discovered an exuviated "skin" in a tangle of ivy growing on a cultivated Mexican fan palm (*Washingtonia robusta*) an estimated 65 feet above the ground. Undoubtedly the long tail is an indispensable aid in climbing and when disturbed from an arboreal position these lizards sometimes momentarily suspend themselves from a branch by their tail before dropping to the ground. While numerous such instances of arboreal behavior are available for this subspecies, the practice is possibly even more prevalent than now realized; the elongate body and tail and drab coloration of these lizards, coupled with their remaining motionless until approached closely, makes them extremely difficult to detect in brush tangles.

Sceloporus sp. Several species of *Sceloporus* in western North America make wide use of the arboreal habitat. In southern California this is particularly true of *S. occidentalis biseriatus* Hallowell, which wherever found is commonly observed on the trunks and branches of trees as high as 60 feet or more above the ground. On the Mojave desert, *S. magister uniformis* Phelan and Brattstrom is commonly discovered on branches of the Joshua tree (*Yucca brevifolia*), and Vial (1953, The reptiles of the San Jacinto area of southern California. Master's Thesis, Long Beach State College, Calif.) found that mesquite (*Prosopis* sp.), ocotillo (*Fouquieria splendens*) and fan palm (*Washingtonia filifera*) also serve as perching sites. Not infrequently these lizards can be discovered at night by walking through a Joshua tree "forest" and shining a flashlight upward into the branches. Vial (*op. cit.*) also found *S. o. orcutti* Stejneger frequenting the branches of the fan palms. In the higher mountains *S. graciosus vandenburgianus* Cope will unhesitatingly climb the trunks of trees when disturbed from their usual ground or saxicolous habitat.

Masticophis flagellum (Shaw). The arboreal habits of this species are well known (Stebbins, 1954, Amphibians and Reptiles of Western North America) and little new data can be added except to state that the recently described *M. f. ruddocki* Brattstrom and Warren is no exception. On May 22, 1954, a specimen was observed to enter an *Atriplex* bush

near Maricopa, Kern County, and come to rest about three feet above the ground, where it remained motionless until touched.

Masticophis l. lateralis Hallowell. This species is commonly captured in low bushes and trees. To cite a specific example, the writer captured on the afternoon of July 27, 1954, along the Mojave River a *M. lateralis* lying over 10 feet above the ground in a mountain alder (*Alnus rhombifolia*). The snake's color pattern of two longitudinal light stripes affords it better protection in an arboreal position than on the ground.

Thamnophis elegans hammondi Kennicott. While climbing the tree to capture the *Masticophis* cited above, the writer sighted one of these garter snakes at nearly the same level above the ground in an adjacent *Alnus*. As in the previous case the snake made no attempt to climb higher when approached and moved only when touched. In this instance, at least, excessive ground temperatures were not responsible for the snake having climbed the tree; the air temperature at its level in the tree was actually several degrees higher than that of the damp and shaded soil at the tree's base.

Lampropeltis zonata parvirubra Zweifel. Near Lake Arrowhead in the San Bernardino Mountains one of these snakes was discovered coiled in a decaying cavity of a black oak (*Quercus kelloggi*) over five feet above the ground. Possibly this is somewhat anomalous behavior for this species. The writer has captured over two score of these snakes in the above mentioned region but never before has one been found other than on the ground and usually under surface objects. In the laboratory, however, these snakes climb readily, particularly if no surface shelter is available to them.

Pituophis catenifer annectens Baird and Girard. In the San Bernardino Mountains this species is regularly captured in the low branches of *Ceanothus cordulatus* and *Ribes* sp. and in the Santa Monica Mountains has been captured over six feet above the ground in live oaks. In captivity many specimens choose to climb rather than take shelter under the surface objects provided.

Crotalus viridis helleri Meek. On numerous occasions the writer has found these rattlesnakes coiled as high as 5 feet above the ground in thickets of *Ceanothus cordulatus* in the San Bernardino Mountains. Young rattlesnakes in the fall of the year are often seen a foot or two above the ground in almost any substantial shrub or small tree. An additional observation of arboreal activity was afforded on May 22, 1954, at 5:05 p.m. along the West Fork of the Mojave River. Dominant vegetation in the area is California juniper (*Juniperus californica*), Great Basin sagebrush (*Artemisia tridentata*) and Fremont cottonwood (*Populus fremonti.*) When first observed the snake was coiled on the ground 4 feet from the base of a *Juniperus* and 2 feet from a large *Neotoma* nest. When disturbed by the collector's approach the snake crawled toward and climbed the *Juniperus* without hesitation, apparently seeking escape in that direction in preference to the *Neotoma* nest, and came to rest coiled on a horizontal limb over 3 feet above the ground. In captivity, climbing behavior has been tested and noted on numerous occasions. The relatively

heavy bodies of the rattlesnakes seem not to hinder their arboreal agility in the least.

Crotalus cerastes laterorepens Klauber. Because the sidewinder has become highly specialized for their preferred arenaceous habitat it was with some surprise that arboreal tendencies were observed in this species. In the laboratory, these snakes have been observed on several occasions coiled 2 to 3 feet above the sandy cage floor on the horizontal branches of a large *Cercocarpus betuloides* bush placed in the cage. To be sure, these observations were made in the laboratory where many forms behave radically different than they do in nature but it seems advisable to record them as a basis for future field observations.

Crotalus atrox Baird and Girard. In the same cage mentioned immediately above, *C. atrox* has similarly been observed coiled as high as 3 feet above the cage floor in the large *Cercocarpus* bush.

DISCUSSION

When the reptiles, especially snakes, are discovered in an arboreal position their usual behavioral pattern seems rather consistently to be one of reliance on coloration and/or position for protection. Instead of attempting to escape they simply lie motionless and usually move only when actually touched. This, however, is not the case with certain lizards, particularly the several species of *Sceloporus*, which immediately climb higher upon being disturbed. At the same time they circle the tree so as to remain opposite the disturbing source.

Knowledge of the microenvironmental relations of ectotherms is, as yet, so meager that it is impossible to explain adequately on these grounds the arboreal behavior of the reptiles and amphibians cited. A combination of physical factors (temperature, light, humidity, etc.) coupled with largely unknown psychological factors undoubtedly cause the animals to climb. While escape from enemies is probably largely responsible for most climbing behavior, feeding is at least partially responsible for some species (*Callisaurus, Dipsosaurus* and *Masticophis flagellum*) becoming arboreal. Avoidance of supraoptimal temperatures on the highly heated substrate is a reasonable hypothesis for explaining climbing behavior in several cases, particularly such diurnal desert forms as *Callisaurus* and *Dipsosaurus*. The rather general use of the arboreal habitat, and similar behavior patterns among the different species despite their wide morphological modifications, may mean that certain common factors are concerned but much field work and further laboratory experiments are necessary before this problem is adequately understood. Whether any of the species of arboreal reptiles and amphibians cited practice parachuting (*Oliver, op. cit.*) is as yet undetermined. As Cowles (*op. cit.*) has suggested, the arboreal habitat to most southwestern herpetologists is a collectors' blind spot sorely in need of further exploitation.

DEPT. OF ZOOLOGY, UNIV. OF CALIF., LOS ANGELES 24.

The Eggs and Larvae of the Yosemite Toad *Bufo canorus* Camp

By ERNEST L. KARLSTROM *and* ROBERT L. LIVEZEY

The few published references on the natural history of the Yosemite toad include little information on the larva and no description of the eggs or the manner in which they are deposited. While engaged in research during 1954 on the ecology of *Bufo canorus,* Karlstrom collected eggs at two localities. The northernmost site is 200 yards northeast of the Tioga Pass Ranger Station, 9900 feet, Mono County, California, visited June 19, 1954 (MVZ 61790), and the second locality is near the presently known southern limit of the range of the species, Kaiser Peak Meadows, 8000 feet, 2½ miles northwest of Kaiser Pass Summit, Fresno County, California, visited May 26, 1954 (MVZ 61788). Livezey in 1952 obtained tadpoles and metamorphosed toads at two localities—east base of Mount Conness, 10,000 feet, Mono County, California, July 30, 1952 (MVZ 61795), and 1½ miles south of Ebbett's Pass, 7800 feet, Alpine County, California, August 11, 1952 (MVZ 61796). The Ebbett's Pass locality represents a northward range extension of the species (Livezey 1955). For comparative purposes larvae of *Bufo boreas halophilus* B. & G., have been collected at Yosemite Valley, 4000 feet, Yosemite National Park, Mariposa County, California, May 24, 1954 (MVZ 61805) and 6½ miles east of Avery, 4175 feet, Stanislaus County, California, June 7, 1954 (MVZ 61838).

Measurements of formalin-preserved eggs were made with the aid of a binocular dissecting microscope fitted with an ocular micrometer calibrated to 0.01 mm. All measurements (see Table 1) have been rounded off to the nearest 0.1 mm. The larvae were measured with a vernier caliper following preservation in ten per cent formalin and storage in four per cent formalin. Color analyses were made on both living and freshly preserved ova[1] and tadpoles.

The literature on amphibian eggs contains a confusing array of terms, and there is a distinct need for clarification and standardization of terminology. An amphibian "egg" as referred to in this paper includes the ovum and its encapsulating jelly layers. The ovum (vitellus) is that part which develops into the future animal. A vitelline membrane, which lifts off the ovum as the fertilization membrane following sperm entrance, surrounds the ovum; and the fluid-filled space internal to the vitelline membrane is termed the perivitelline space. In many amphibian eggs an additional fluid-filled space, the capsular chamber, may be present outside the vitelline membrane due to liquefaction of the innermost jelly layer. The gelatinous envelopes vary in number and thickness. Measurements of the envelopes are maximum diameters of each jelly coat.

The Yosemite toad lays the eggs in strings, which may be elongate single or double strands, or the eggs may be variously attached forming a radiating network or a cluster four or five eggs deep (Figure 1). Two

[1]In a strict sense, the ovum is a mature female gamete. The materials herein described are actually fertilized eggs, but the use of the term ovum seems justified because of usage and convenience.

jelly envelopes are present, the outer forming a scalloped, but continuous gelatinous encasement, whereas the inner envelope surrounds each ovum and is usually in apposition to the inner envelope of the adjacent ovum. Maximum width of the outer envelope is 3.7 to 4.6 mm., average 4.1 at the thickest point in a single row (see Table 1). At the point of constriction between successive ova the width is highly variable, 0.5 to 3.9 mm., but averaging 2.6 mm. The diameter of the inner envelope is 3.4 to 4.1 mm., average 3.8. The fertilization or vitelline membrane (not figured) lies closely apposed to the surface of the ovum; hence the perivitelline space is small. The portion of the capsular chamber between the ovum and the inner jelly envelope is a few tenths of a millimeter wide.

Table 1. Eggs from Two Populations of *Bufo canorus*. Average in mm. followed by the range in brackets; N=10* for each population; data on *Bufo boreas halophilus* from Livezey and Wright 1947.

	Diameter Outer envelope max.	Diameter Outer envelope min.	Inner envelope	Diameter ovum	Eggs/ inch (strings)	Total eggs/ female
Tioga Pass.....	3.9 (3.7-4.1)	2.3 (0.5-3.4)	3.5 (3.4-3.7)	2.0 (1.7-2.2)	7-8	.....
Kaiser Pass.....	4.3 (4.1-4.6)	2.7 (1.0-3.9)	4.0 (3.9-4.1)	2.3 (2.2-2.7)	6-7	.....
Both samples.....	4.1 (3.7-4.6)	2.6 (0.5-3.9)	3.8 (3.4-4.1)	2.1 (1.7-2.7)	7 (6-8)	1500-2000[2]
Bufo boreas halophilus....	5.1 (4.9-5.3)	.....	3.6 (3.5-3.8)	1.7 (1.65-1.75)	27 (13-52)	16,500

*Sample size of 10 for each population.

The round ova vary in color from brownish-black or jet black over the upper three-fourths to gray or tannish-gray in the region of the vegetal pole. Ova diameters range from 1.7 to 2.7 mm., average 2.1. Approximately 6 to 8 eggs per inch occur in single file along the length of a string. Many of the strings had eggs occuring in "couplets," that is, a pair of eggs close together but separated from the next set by a gap. It appears as if the female laid the eggs in short spurts, but this has not been verified. Exact data are lacking on the total number of eggs laid by a single female. An estimate of 1500-2000 eggs per toad was arrived at by determining the approximate number of pigmented ovarian eggs in two preserved females taken in prebreeding condition. The volume of 100 pigmented eggs plus associated immature follicles and stroma was measured in a 10 ml. graduate, and this sample was used to estimate the total number of eggs present in the total volume of the ovaries.

Descriptions of amphibian eggs and larvae rarely take into account variation existing within a single population or over the distributional range of the race or species. For this study we lack adequate egg samples representing different matings within the same population, but the material available from the Tioga Pass and Kaiser Pass localities suggests that differences exist (Table 1) between populations 45 airline miles apart. In addition to larger size the Kaiser Pass ova tend toward brownish rather than black pigmentation. The basis for these differences in egg

[2]Figure based on the ovarian eggs of two preserved specimens from Yosemite National Park, California.

size and color is not known, and further research is necessary before adequate analysis of variation in the eggs of *Bufo canorus* can be presented.

The presence of tadpoles may or may not be indicative of the nature of the situation where the eggs were laid. Myers (1930:63) observed *canorus* tadpoles at Peregoy Meadow, 7100 feet, Yosemite National Park in small muddy depressions in the wet meadow. The holes suggested hoof tracks to the author due to their small size and close spacing. It is probable that these larvae had been stranded in the shallow depressions following the drying up of most of the deeper water where the eggs had been deposited. Livezey in 1952 collected tadpoles near Ebbett's Pass in water 2 to 3 inches deep in runoff streams and along the shallow margins of a pond 6 by 15 feet.

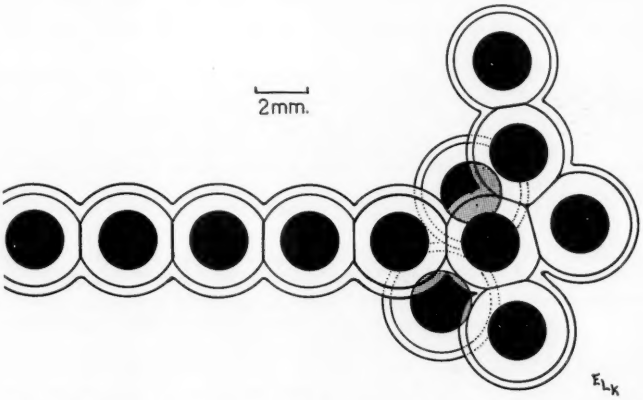


Fig. 1. Diagram of the eggs of *Bufo canorus* Camp. The capsular chamber present in fertilized eggs is not shown.

The deposits of eggs observed by Karlstrom varied in size and spacing. At Kaiser Peak Meadows only two small groups of eggs were found. One covered a roughly circular area 9 by 7 inches, and the second group, four feet away, was spread over an area approximately 3 by 8 inches. The two adult females found with the eggs did not yield additional eggs when squeezed, and a later examination of their oviducts showed that they were spawned out. The bottom of a large snow run-off pool was composed of dark loose silt which covered the eggs. Under these circumstances the eggs are difficult to see, and other egg groups could have been overlooked, although a diligent search revealed no additional eggs. At Tioga Pass a shallow pool 40 by 15 yards contained two patches of egg strings 20 feet apart. Recently hatched tadpoles were present, but they had not dispersed to any appreciable extent beyond the local area where they developed. Egg strings extended over one area approximately 3 by 6 feet and over another area 3 feet square 20 feet away. Both egg patches were located along the

same side of the pool, where water depth did not exceed two inches. Meadow grasses and sedges extended above the surface of the water, and silt particles covered the jelly strings. The Tioga Pass female or females must have engaged in considerable movement during amplexus since the strings were wound among the grasses in the pool.

Stebbins (1951:247) provides a brief description of *Bufo canorus* larvae based on preserved material from Peregoy Meadow, Yosemite National Park, California. The author points out that *canorus* tadpoles closely resemble larvae of the California toad, *Bufo boreas halophilus,* but differ in certain respects. The *canorus* larvae are smaller, darker, possess shorter snouts, and their slightly transparent dorsal fins are marked with relatively large branched melanophores. Stebbins' description of *canorus* was based on a small sample preserved in 1928. On the basis of our own observations on living and freshly preserved tadpoles of both species, we wish to corroborate his description and present additional details.

On the basis of material examined, *Bufo canorus* larvae are slightly smaller than *B. boreas halophilus;* the mean total lengths of twenty larvae are 22.1 and 25.2 mm. respectively, although the ratio of body length/total length is almost identical (Table 2). The largest *canorus* tadpoles were collected by Livezey near Ebbett's Pass, Alpine County, California. Twelve larvae ranged 31.0 to 35.5 mm. total length, average 33.4 mm. Storer (1925: 171) records the maximum length of *B. boreas halophilus* larvae at 56 mm. When viewed from above the outline of the snout region is more rounded in *canorus,* whereas the tip is relatively truncate in *boreas* (Figure 2, a & b). The relative snout length (distance from anterior margin of eye to tip of snout) is slightly less in *canorus.* In lateral view (Figure 2, c & d) the rostral profile appears slightly more blunt than that of *boreas.* Differences in tail shape are more striking. The tail of *canorus* tadpoles is deepest approximately midway along its length; in *boreas* it is deepest about one-fourth the tail length posteriad from the anus. The tip is broadly rounded in *canorus,* more pointed in *boreas.*

Yosemite toad tadpoles are more melanistic overall than *boreas.* The possibility that deeper larval pigmentation might impart a slight selective advantage due to increased absorption of solar heat is being investigated. Any factor tending to speed up the growth rate would be important to a species occupying high altitudes where the period of time available for growth is short.

The following color notes were taken on an anesthetized *canorus* tadpole with a body length of 8.2 mm., tail 10.8 mm. Overall body coloration is a gray-black, darkest where the body exhibits greatest depth. The intestines of *canorus* are barely discernible, whereas in the lighter *boreas* they are more readily seen. The grayish-black peritoneum and intestinal wall of both species appear identical in color, so the differences in depth of color are the result of differences within the skin itself. Scattered over the dorsal and lateral body surfaces are tiny flecks of copperish-gold which are practically invisible to the naked eye. Practically no metallic flecking appears ventrally over the body, and it is altogether absent from the tail. In *canorus* the iris appear as a copperish-yellow ring.

The tails of *Bufo canorus* larvae studied are translucent as compared to the quite transparent tails of *boreas*. Three melanophore types based on shape are perceptible in the tails of these tadpoles: minute punctate, punctostellate, and large stellate branched melanophores. The background color of the tail in *canorus* consists of dense, uniformly distributed melanophores of the first type; *boreas* has few of them. Similarly the tail of *canorus* has more roundish, punctostellate melanophores than *boreas*. *Carorus* has numerous large stellate melanophores almost forming a reticulum in its dorsal fin. *Boreas* has fewer expanded melanophores in the dorsal fin, and those present are thinner and more elongate. A few, large elongate melanophores appear in the ventral fin of *boreas*, some smaller ones near the tip of the tail.

Storer (1925: 42) has figured the mouthparts of the Yosemite toad. As in *Bufo boreas* and other American toads as summarized by Orton (1952: 385), the tooth rows are 2/3, the lips are infolded laterally, and the marginal papillae are present only around the sides of the lips. The second upper tooth row (adjacent to the upper mandible) is interrupted by a median gap. In approximately ten per cent of the 82 *canorus* and *boreas* tadpoles we examined there was a slight median gap in the first lower (adjacent to the lower mandible) tooth row. Distinctive mouthparts separating the species have not been observed.

Table 2. A Comparison of the Larvae of *Bufo canorus* and *Bufo boreas halophilus*.[3]

	Bufo canorus (Tioga Pass)	*Bufo boreas halophilus* (Yosemite Valley)
Size: (mm.)[3]	smaller	larger
snout-vent	10.2 (9.8-10.6)	11.8 (10.8-12.7)
tail	12.0 (11.2-14.2)	13.4 (11.8-15.3)
total	22.1 (20.0-24.7)	25.2 (23.0-26.4)
Ratio body length/ total length	0.461	0.468
Shape:		
snout profile	truncate	flattened
tail	deepest midway body and tip tip broadly rounded	deepest ¼ distance body to tip tip relatively pointed
Color:		
body	very dark	somewhat lighter
tail	slightly transparent	quite transparent
Tooth formula:	2/3 with gap in first upper labial tooth row	same

Stebbins (*op. cit., page 245*) suggests that *Bufo canorus* may be a high mountain differentiate of *B. boreas*, and that interbreeding between the two forms probably occurs along the east-west drainages of the western and perhaps eastern slope of the Sierra. To date the two species have not been found together. The reference to sympatry in the Kaiser

[3]The mean of ten larvae of each species at equivalent stages in development with small hind limbs of about the same relative length (less than 2 mm.).

Pass area, Fresno County, California, as reported in Stebbins' account (p. 248), appears to be erroneous. All MVZ specimens from egg stage to adult taken in the area by Karlstrom and others have been identified as *Bufo canorus*. In most parts of the Sierra the altitudinal separation between *canorus* and *boreas* is in the magnitude of 2000 to 3000 feet. The apparent geographic isolation of *canorus*, smaller size (except *B. boreas exsul*), and striking sexual dichromism are important characters separating the Yosemite toad from the complex of *Bufo boreas* encircling it. Another striking difference now appears in the form of its eggs. The two jelly

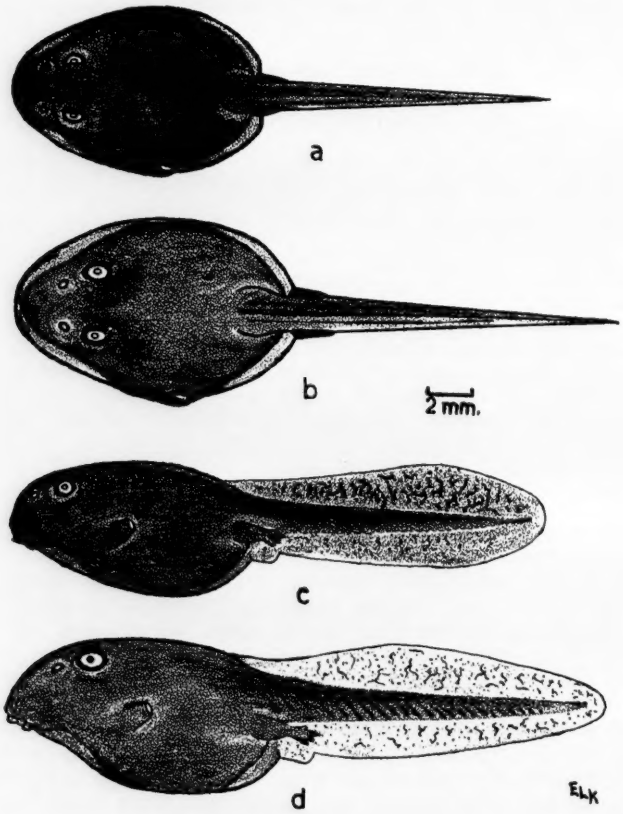


Fig. 2. Dorsal and lateral views of *Bufo canorus* (a & c) and *Bufo boreas halophilus* (b & d).

envelopes of *boreas* eggs form a continuous double tube; no partitions separate individual ova as in *canorus*. *Boreas* ova are smaller (Table 1), occur in either a single or double row within the file, whereas *canorus* ova always occur in single file when in the forms of a string. Where they have been observed, the eggs of *boreas* are deposited in elongate, mostly double strings over a wide area. At a pond in Richmond, California, Karlstrom traced out an unbroken string of *B. b. halophilus* eggs which was over 12 feet in total length. *Canorus* eggs, on the other hand, occur in short strings and/or clusters. When in strings the eggs of the Yosemite toad more closely resemble the eggs of *Bufo cognatus*, the Great Plains toad (Livezey and Wright 1947: 194), than other American toads. The possible adaptive significance of differences in the size and form of *Bufo canorus* eggs when compared with other toads is not known at the present time. Further study of the early stages in the life history of this species should provide important clues to its adaptations to a montane existence.

We wish to extend our appreciation to Dr. Robert C. Stebbins who kindly read the manuscript and offered suggestions.

LITERATURE CITED

Livezey, R. L. and A. H. Wright. 1947. A synoptic key to the salientian eggs of the United States. Amer. Midl. Naturalist, 37 (1): 179-222, figs. 1-82.

Livezey, R. L. 1955. A northward range extension of *Bufo canorus*. Herpetologica 11(3): 212.

Myers, George S. 1930. Notes on some amphibians in western North America. Proc. Biol. Soc. of Wash., 43: 55-64.

Orton, Grace L. 1952. Key to the genera of tadpoles in the United States and Canada. Amer. Midl. Nat., 47 (2): 382-395, 21 figs. in text.

Stebbins, Robert C. 1951. Amphibians of western North America. University of California Press, Berkeley and Los Angeles, pp. 1-539.

Storer, Tracy I. 1925. A synopsis of the amphibia of California. Univ. of Calif. Publ. Zool., 27: 1-342, figs. 1-42, pls. 1-18.

MUSEUM OF VERTEBRATE ZOOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, AND SACRAMENTO STATE COLLEGE, SACRAMENTO, CALIFORNIA.

SOME NOTES ON REPTILES.—On the 28th of May, 1955, a female Eastern Spiny Soft-shelled Turtle (*Trionyx ferox spinifera* Le Sueur), was caught along the bank of the Clarion River near Clarion, Penn., by the author and Russell Lee, also of Pittsburgh. After our arrival home, it was taken to the Carnegie Museum for official measurement as it appeared to be close to the record of this species. Neil Richmond, Curator of the Dept. of Herpetology, gave the measurements as follows (all are straight line measurements):

Shell length: 405 mm.; Bony shell: 230 mm.; Max. width: 310 mm.; Weight 14½ pounds. Archie Carr lists the largest in his Handbook of Turtles as 407 mm., measured by Lagler. It was a Michigan specimen, but no data were given.

On the 7th of June, 1955, at 9 a.m., a female wood turtle (*Clemmys insculpta* Le Conte), was observed by the author digging a hole five inches in diameter and about eight inches deep. She deposited seven eggs, four of which were removed for artificial hatching, but spoiled shortly after. The three remaining eggs, left where the female buried them, hatched in seventy-seven days on August 22nd. The young are a uniform gray-brown. The carapace measures 41 mm. long and 42 mm. wide. The tail measures 34 mm. These hatchlings weigh 8.6 grams.

I received one female Broad Banded Copperhead (*Agkistrodon contortrix laticinctus* Gloyd and Conant), from the Biology Department of Texas Christian University in July 1954. On the 24th of August she gave birth to five healthy young, measuring an average of 220 mm. and weighing 8.7 grams. Since arrival at the zoo she has shared her cage with no other snakes. This year on August 20th she again gave birth to five healthy young, having slightly larger measurements than the young born last year. The smallest is 230 mm., weighing 11.5 grams and the largest is 253 mm. weighing 16 grams. During this time she has had no contact with any males.—William B. Allen, Jr., Curator of Reptiles, Highland Park Zoo, Pittsburgh, Penn.

CNEMIDOPHORUS SEXLINEATUS LINNAEUS IN ILLINOIS.—*Cnemidophorus sexlineatus* L., is one of the rare lizards of southern Illinois and therefore has seldom been reported from this area. The author has one specimen collected at Benson Bluff near Goreville, Illinois, May 30, 1932; another specimen on May 2, 1950, at Pine Hills, Union County State Park; and at Equality, Illinois, October 6, 1952. This past spring a male and female were found at Burden Falls near Belle Smith Springs on May 7, 1955. These data indicate that although not abundant, this species extends from the east to the west side of the southern part of the state. These specimens are in the Zoology Department of Southern Illinois University.—Hilda A. Stein, Southern Illinois University, Carbondale, Illinois.

The Identity of the Puerto Rican Species of *Phyllodactylus* (Reptilia: Squamata)

By HAROLD WM. KERSTER AND HOBART M. SMITH

Among reptiles recently acquired by Major Chapman Grant, and kindly presented by him to the Museum of Natural History of the University of Illinois, is a series of geckos of the genus *Phyllodactylus* secured on the isolated island of Caja de Muertos near Puerto Rico, through the offices of his friends, Mr. and Mrs. Juan A. Wirshing. Knowing the great interest of this, the only species of the genus in the Greater Antilles, Major Grant generously offered the authors the privilege of fixing its identity. Comparative materials were made available through the kindness of Mr. Robert F. Inger of the Chicago Natural History Museum, and Mr. Arthur Loveridge of the Museum of Comparative Zoology.

Phyllodactylus wirshingi, sp. nov.

Holotype. Univ. Ill. Mus. Nat. Hist. No. 37740, collected on Caja de Muertos, Puerto Rico, March 10, 1953, by Mr. Juan A. Wirshing.

Paratypes. Three topotypes, UIMNH Nos. 37741-3; and two (Mus. Comp. Zool. Nos. 34649-50) from Parguera, Puerto Rico, collected by Chapman Grant.

Diagnosis. A small *Phyllodactylus* attaining a snout-vent length of 43-49 mm; occipital tubercles of relative uniform size, either large or small, the large granules separated from each other by very small granules, none of intermediate size; at least rear and middle interorbital tubercles separated from each other by granules; frontonasal scales subequal to or slightly smaller than occipital granules; tubercles on dorsum tricarinate subequilateral trihedrals of moderate height, in 9-11 rows on each side, separated from each other by 1-2 rows of clearly defined, small, flat, seemingly imbricate granules; dorsal and posterior aspects of femur strongly tuberculate; tail but little longer than head plus body; width of distal dilation of fourth toe less than height of ear opening; eleven lamellae under fourth toe, distal lamella divided; anal pores at level of posterior edge of cloacal lip and bordered anteriorly and laterally by L-shaped (Fig. 1) cloacal bones possessing disc-shaped expansions at their posterior ends; four broad, transverse dark bands between middle of neck and sacrum, clearly evident in adults as well as in young. Related to *P. martini,* from which it differs most conspicuously in having the interorbital tubercles separated from each other, and large tubercles on rear of thighs.

Description of Holotype. An adult male; head flattened, elongate; snout rounded; frontonasal groove deep; interorbital scales in about four rows, subequal in size to the median frontonasals, all except the anterior ones actually separated from each other by small granules; 3-4 rows of supraocular tubercles, laterals largest, equal to largest canthals; numerous small, conical or subtrihedral tubercles in occipital and temporal regions, all subequal in size and distinctly separated from each other by small

granules; 5-6 upper and 5 lower labials to a point below middle of eye; rostral about twice as broad as high; mental a large equilateral triangle; two large, irregularly pentagonal postmentals, broadly in contact medially, narrowly bordering first labial laterally and starting a series of scales decreasing posteriorly in size to minute imbricate gular scales and axillary granules; area between eye and ear with large, isolated tubercles among small granules; 1-5 dorsal granules separating tubercles; 26 dorsal tubercles in paravertebral rows from anterior border of arm to rear of thighs; dorsal tubercles in 20-22 rows, in form of large equilateral trihedrals laterally, the paravertebral tubercles more elongate, the symmetry in general being less evident medially; 22 longitudinal rows of ventrals at midbody; 42 ventrals from axillary level to anus; subdigital lamellae 7-7-10-11-7; distal lamella under 4th toe divided; a few tubercles on anterior aspect of humerus; dorsal and posterior surfaces of femur strongly tuberculate; a few scattered tubercles on dorsal surface of tibia; a few tubercles on dorsal surface of foot; scales in groin small and granular; cloacal wall produced backward externally more than one half width of distal dilation of fourth toe; postanal pores at level of rear edge of external portion of cloacal wall and lying in angles formed by the L-shaped cloacal bones; cloacal bones flattened horizontally and slightly expanded at their posterior ends.

Fig. 1. Cloacal bones and cloacal pores of *Phyllodactylus wirshingi,* ventral view. Line anterior to cloacal bones represents posterior glandular lip of cloacal opening.

Color (in alcohol) yellow-brown above; a dark brown stripe from orbit to shoulder; dark brown bands dorsally and on limbs, six of full length crossing back between head and sacrum, another of half length at rear of occiput; bands fading into background color laterally; bands appearing double, darkest at their anterior and posterior edges and fading to yellow-brown at their centers; dark bands separated by narrow light bands, 6 between occiput and sacrum; head yellow brown with dark brown reticulations.

Snout-vent, 48 mm.; tail missing; head to rear of tympanum 14 mm.; width of head 9.7 mm.; foreleg 14 mm.; hind leg 19 mm.

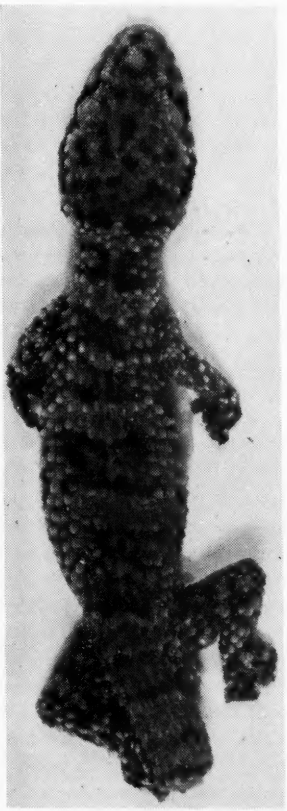
Variation. Three adult females 48.5 mm., 45.8 mm. and 43 mm. in snout-vent length vary quantitatively only in the number of upper labials,

each having 6 on the right side. Pattern and color intensity are similar to that of the holotype. In all the females the cloacal wall is produced backward less than one-half as far as in the holotype and the postanal pores are slightly forward of the rear edge of the cloacal wall.

The single specimen with an intact tail is a juvenile measuring 36 mm. from snout to vent. The tail length measures 39 mm. There are about 20 scales per whorl at the level of the adpressed knee. The dorsal surface of the tail is covered with rough, carinate, imbricate plates; ventral scales of tail smooth, not sharply differentiated from dorsals, median row about 2½ times as wide as others; dark bands on tail extremely conspicuous, especially toward tip, separated by lighter interspaces than on body.

The smallest specimen measures 29 mm., snout-vent; its pattern is more boldly defined than in the others. In all specimens exactly the same number of bands occurs on neck and trunk.

Remarks. The history of knowledge of the species here described begins with the reference by Grant and Roosevelt (1932, Jour. Dept. Ag., Puerto Rico, 16: 47), of a single specimen from Caja de Muertos to *Phyllodactylus tuberculosus*. This was the first record of the genus in the Greater Antilles. A more complete discussion of the significance of this find, with an additional record for Parguera, Puerto Rico, followed later the same year (Grant, 1932, Jour. Dept. Ag. Puerto Rico, 16: 335-337, pl. 39). In the second article the specimens were referred to *P. pulcher* Gray, an identity reasonably supported by the revisions then available.



Pl. 1. *Phyllodactylus wirshingi*, male holotype.

In 1935 Parker (Ann. Mag. Nat. Hist. ser. 10, 15: 480-484) reviewed the confusing history of and examined critically all *Phyllodactylus* from the West Indies, restricting *P. julieni* Cope to Aruba, *P. pulcher* to the Barbados, *P. martini* to Curacao, Bonaire and Klein Bonaire, and a new species *P. mulleri* to Venezuela and Patos Island. This revision has never been superseded, as it dealt definitively with the problem with the single

exception of the Puerto Rican and Caja de Muertos population. Of this Parker states: "A form closely allied to, if not identical with, *P. martini* occurs on Puerto Rico and the islet Caja de Muertos off its southern coast. A specimen from Parguera (Puerto Rico) collected by Major Chapman Grant, and now in the Zoological Museum of the University of Michigan, has been examined; it differs from examples from Curacao and Bonaire only in characters which seem too trivial to be of specific importance."

It was accordingly with little expectation of finding differences that we compared two topotypes of *P. martini* from Curacao with the present series from Caja de Muertos and Puerto Rico. To our surprise three conspicuous differences as well as a number of less easily definable ones were discovered. Although the relationship with *P. martini* is clearly borne out by these comparisons, the differences seem as great as those between other species of the genus in the Dutch Leeward Islands, and accordingly we at least tentatively assign the Puerto Rican population to specific rank.

Actually the entire group of West Indian species of *Phyllodactylus* appears to represent allopatric differentiates of the *tuberculosus* group. Certainly *P. martini* and *P. wirshingi* resemble certain Mexican species of this group, but not only do morphological differences exist but also the geographic picture rules out a specifically close relationship save by dispersal at the hand of man, in turn eliminated from reasonable probability by the differences themselves.

From *P. martini,* the only form with which close relationship may reasonably be suspected, *P. wirshingi* differs most conspicuously in having (a) the interorbital scales (except anteriorly) definitely separated from each other by tiny granules, not in contact as in *P. martini;* (b) large tubercles on the upper part of the rear surface of the thigh, whereas in *P. martini* the tubercles of the same area are either absent or scarcely discernible; and (c) the occipital scales in the form of large tubercles scattered among small granules, whereas in *P. martini* they are for the most part tubercles of various sizes, usually not separated by the few granules present. Additional differences include a distinct scutellation of the dorsal skin between the tubercles, and 5 dark bands between postoccipital area and sacrum, in *P. wirshingi;* in *P. martini* there are few scales or granules between the tubercles of the trunk, and in the single young specimen 6 dark bands are present between the postoccipital area and sacrum (the adult appears to have 5). The markings are apparently not as distinct in adult *P. martini* as in *P. wirshingi.*

Unfortunately the two specimens examined of *P. martini* lack cloacal bones (female and juvenile). Differences in shape of this structure, if any, remain to be discerned.

MUSEUM OF NATURAL HISTORY AND DEPARTMENT OF ZOOLOGY, UNIVERSITY OF ILLINOIS, URBANA

The Evolutionary Relationships of the Narrow-Lined Skinks of the Inland Southwest, *Eumeces taylori, E. gaigei,* and *E. multivirgatus*[1]

by CHARLES H. LOWE, JR.

While engaged in herpetological investigations in New Mexico during 1947-1950, additional specimens of the little known skinks *Eumeces gaigei* and *E. taylori,* and the related *E. multivirgatus* were collected by the author, K. S. Norris, and R. G. Zweifel. All were studied as living and fresh specimens. *E. gaigei* was collected in the Sacramento and Sandia Mountains, *E. taylori* in the Guadalupe Mountains, and *E. multivirgatus* at localities in more northern parts of the state (see below). With the collection of *E. gaigei* in the Sacramento Mountains, this form is now known to occur in another mountain range in which *E. multivirgatus* also occurs (*fide* Taylor's allocation for Ruidoso Creek, *in* Univ. Kans. Sci. Bull., 1935, 36(14): 000).

From analysis of the fresh material and the studies of Taylor (1935) and of Smith (1942, Proc. New Engl. Zool. Club, 21: 93-95; 1946, Handbook lizards), it seems quite evident that these three so-called species may represent conspecific populations. The following is observable: (1) While skinks are conservative in morphological features, the known significant differences between all three of the forms in question are particularly slight and are not more than matters of color and/or pattern and size. (2) In so far as is known the three forms in question are allopatric; they are nowhere known to be sympatric as breeding populations. (3) A cline of variation exists for color pattern, the only kind of character other than size in which the populations are known to differ significantly; there is a general north-south decrease in intensity of the development of the body stripes in the adult, from the well-striped *multivirgatus* of the north, through the variably-striped *gaigei* in a somewhat geographically central position, to the non-striped *taylori* found only in the south (Guadalupe Mountains).

If one disregards previous nomenclature, thereby momentarily divorcing from the problem the convention of named forms, and proceeds to analyze character geography, it becomes quite clear that these three skink populations of New Mexico (1) vary but slightly morphologically, (2) resemble each other more closely as juveniles than as adults, (3) do not completely segregate geographically, and (4) form a morphological con-

[1]The present report, completed approximately two years ago, was withheld from publication after receiving correspondence from Dr. John S. Mecham now at the University of Tulsa who, it appeared, had arrived at the same conclusions. However, Dr. Mecham's conclusions, drawn from different data, while in agreement with the general conclusions of the present study as to the conspecificity of *E. gaigei, E. multivirgatus,* and *E. taylori,* differ in important respects, for example, in the complete synonymization of *E. taylori.* As this former "species" *E. taylori* is a distinctive morphologic entity with 100% of the known individuals differing from both *gaigei* and *multivirgatus,* and as it occupies disjunctive and considerable geographic area, the author visualizes *taylori* as a valid subspecies. Dr. Mecham and I are agreed that it is desirable that the present report be now published in its original, unmodified form, insomuch as it presents certain systematic conclusions upon which there are disagreements.

tinuum clearly indicative of actual or potential gene exchange. A logical conclusion from these findings is that the narrow-lined skink populations of New Mexico, currently offered as three species (see Smith, *op. cit.*, 1946), are parcels of a single closed genetic system.

It is even difficult, if in fact it is possible, to make a case for subspecific rather than synonymic relationship of *E. gaigei* and *E. multivirgatus*; it is somewhat easier to make a logical case for at least subspecific distinction of *E. taylori*. At the very most the following maintenance would be permitted, recognizing that even this may be granting a degree of evolutionary divergence not existing:

Eumeces multivirgatus multivirgatus Hallowell
Eumeces Multivirgatus gaigei Taylor
Eumeces multivirgatus taylori Smith

It is the opinion of the author that *m. gaigei* and *m. multivirgatus* (both occurring in at least two mountain ranges of New Mexico) represent polymorphism in a single species resulting from low genetic penetrance and expressivity in some breeding populations, and in some individuals of other breeding populations. If this be not so, species status is not a reasonable alternative. It appears probable that there will be future demonstration of the pattern of *m. multivirgatus* in some juvenile *m. gaigei* at a locality at which the pattern of *m. multivirgatus* is not present in the adults of the population.

The fact that two morphological types seemingly not subspecies could be something other than species, appears to have been held previously as unworthy of consideration in treatment of these taxa. Taylor (*op. cit.*, 1935:357) says of *gaigei* and *multivirgatus*, "Despite the scale relationship of this form [*Eumeces gaigei*] with *E. multivirgatus*, I do not regard it as a subspecies [*but as a species*] since the two forms occur together from New Mexico (Taos) to Texas (Guadalupe Mountains)." The alternative that dimorphism or polymorphism is represented within a single species is not considered by Taylor (*op. cit.*, 1935) or by Smith (*op. cit.*, 1942).

Smith (*op cit.*, 1942) subsequently described the third major variant (in the Guadalupe Mountains) as a distinct species, naming it *E. taylori*. Taylor (*op. cit.*, 1935) earlier considered this form as *E. humilis* Boulenger. Of this form Taylor (*op. cit.*, 1935:362) says, "The species appears to be related to *Eumeces multivirgatus*, and the scale formulae and patterns, as well as the general body contours, are approximated by that species. . . . The very striking differences in markings and color should assure their proper identification." *E. m. taylori* is known to differ from *m. multivirgatus* only in color pattern and size. At most, *taylori* may be recognized as a subspecies. The onus of proof that *taylori* is a species rests upon those who would assign it such status. My views on the onus of

proof in the species vs. subspecies problem are precisely as recently stated by Pitelka (1951, Univ. Calif. Publ. Zool., 50:375).

Placement of allopatric differentiates (that are in question) in one species also emphasizes their close morphogenetic and phylogenetic relationships rather than obscuring them by the use of a binomial which does nothing in itself to indicate close relatives and the species group related. In the present case there can be little logical argument for treating the forms as other than conspecific at the present time. Should *taylori* be found sympatric with *gaigei* or *multivirgatus* in the Guadalupe Mountains, it would be at least reasonably but not conclusively demonstrated that *taylori* is a species.

The following localities, all in New Mexico, are for specimens collected during the present study and deposited in the Department of Zoology, University of California, Los Angeles. *Eumeces multivirgatus gaigei:* Otero County, 8.8 mi. (along road to Mayhill) E. Cloudcroft, Sacramento Mountains, ca. 6900 ft. (1), and 8.6 mi. NW Mayhill (1); Bernalillo County, 1.7 mi. N. Sandia Peak, Sandia Mountains (1). *Eumeces multivirgatus taylori:* Eddy County, Sitting Bull Falls, Guadalupe Mountains (2), *Eumeces multivirgatus multivirgatus:* San Miguel County, 3.6 mi. N. Pecos, along Pecos River road to Cowles, Sangre de Cristo Mountains, ca. 7200 ft. (2); Catron County, 5 mi. W. Horse Springs, ca. 7200 ft. (1).

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF ARIZONA.

A RECORD LENGTH FOR THE ARIZONA BULL SNAKE *PITUOPHIS MELANOLEUCUS AFFINIS* FROM ARIZONA.—Klauber (1947, Bull. Zool. Soc. San Diego, 22: 47) tentatively quoted a record length of seven feet, 8 inches (2337 mm.) for *Pituophis melanoleucus affinis* Hallowell. His record was based upon Jackson (1945, Anim. Kingd., 48: 76) and Klauber states that it was not clear whether the snake was *affinis*. Jackson's record was undoubtedly based upon Bailey (1905, N. Amer. Fauna, 25: 47) who collected a *Pituophis m. sayi* (Schlegel) from near Gail, Borden County, Texas, well out of the range of *affinis*. Among numerous other references to Bailey's record are those of Schmidt and Davis (1941, Field Book Snakes: 164) and Stull (1940, Bull. U. S. Nat. Mus., 175: 125). Thus a snake measuring 1880 mm. in length (six feet, two inches) recorded by Stull (*loc. cit.*) is the previous record for *affinis*.

A specimen of *Pituophis melanoleucus affinis* measuring 2186 mm. (seven feet, two inches) was collected at Wickenburg, Arizona, on March 5, 1955, by Drs. F. A. Shannon and F. B. Bralliar. It is on loan to the San Diego Zoo at Balboa Park, San Diego, California.—Gerald O. Gates, Morristown, Arizona.

MORBIDITY OF SNAKES IN THE WILD.—Apparently it is so unusual to find obviously diseased snakes in the wild that they are seldom reported. In reviewing my field notes covering many localities I was struck by how seldom my companions or I had come upon unhealthy snakes in our collecting. It would be wrong to assume, however, that morbidity in the natural state is rare or abnormal. Aside from parasitism, a condition which must be considered normal although unhealthy, otherwise sick or diseased animals are, in all probability, destroyed so rapidly that they seldom come to the attention of collectors or field observers, or perhaps they hide in a secure place until they recover or succumb. No doubt in captivity death can be delayed far beyond what would be possible in nature where enemies and other hazards that exist even for healthy individuals, would rapidly overtake one weakened by disease, thus preventing illness from running its natural course.

An Eastern Diamondback Rattlesnake, *Crotalus adamanteus* Beauvois, collected in southern South Carolina during early April of 1955, was found in a strikingly emaciated condition and seemed generally subnormal except that it did rattle and strike quite vigorously. This specimen was isolated from the rest of the catch to avoid contamination, and on return to Staten Island Zoo was destroyed. Autopsy revealed advanced pneumonia and gastroenteritis together with the presence of a single linguatulid in the body cavity. That this was a doomed snake even before capture seems fairly certain.

A Yellow Rat Snake, *Elaphe obsoleta quadrivittata* (Holbrook), secured in the same region as the rattlesnake mentioned above but two years earlier, was found in obviously bad condition. It suffered advanced "blister disease" and the so-called "belly-rot." One eye was enormously swollen, the pupil and iris completely obscured by accumulation of pus under the ocular shield. King snakes in this region—especially in the Savannah River Wildlife Refuge—are often found with suppurative lesions under and between the ventral shields. This condition is often relieved by a skin moult, but more often the lesions seem to become still more profound after shedding. Such specimens seldom recover in captivity. However, certain antibiotics, notably Bicillin and Syncrobin, have been found to be effective.

Some years ago a Timber Rattlesnake, *Crotalus h. horridus* Linnaeus, that I collected in Dutchess County, New York, died within less than two weeks of capture. There was no immediately apparent reason for this snake to have died so soon, and I was quite certain that I hadn't injured it in capture. With no ready explanation for its sudden demise, it was gratifying to find on autopsy that quite conclusively the cause of death had been a pyloric tumor. This tumor had completely occluded the opening that permits passage of food from the stomach to the intestine. The snake would most certainly have starved to death even if it had not died from other causes attendant upon a malignant growth.

The development of this tumor certainly had its origin while the snake was in the wild and was of particular interest because we find a rather high incidence of malignancies of various types among our captive snakes. It is hoped that others will report instances of ailing snakes found in the wild and that such specimens will be collected and sent somewhere for competent examination.—Carl F. Kauffeld, Staten Island Zoological Society, N.Y.

Notes on the Poisonous Snakes of the Dismal Swamp Area

By JAMES ROBERT MARTIN AND JOHN THORNTON WOOD

Reported here are observations correcting or extending the information recently reported on the poisonous snakes of the Dismal Swamp area (Wood, 1954, Va. Journ. Sci. (n.s.), 5: 152-167).

Ancistrodon contortrix mokeson Daudin

Reported as uncommon and as found only in deciduous woods in Princess Anne County by Werler and McCallion (1951, Amer. Midl. Nat., 45: 245-252), the copperhead was conversely reported by Wood (*op. cit.*) from more localities (19) than was either the cottonmouth (17) or the canebrake rattlesnake (14) in the three Virginia counties comprising the northern half of the Dismal Swamp. Field work by the senior author from 1952 through the summer of 1955 failed to confirm that copperheads are widely distributed in this area, as they were secured in but four localities: Azalea Gardens, Norfolk; Lake Drummond, Dismal Swamp (the largest of all, 42. in. total length); Seashore State Park and Princess Anne Court House in Princess Anne County.

Ancistrodon piscivorus piscivorus Lacépède

The earliest recorded date (April 26) of observation of cottonmouths in the Dismal Swamp area (Wood, *op. cit.*) is nearly two months later than the earliest date secured by the senior author. Dates and numbers of specimens observed or collected in the Gum Swamp, southeast of Stumpy Lake, Norfolk County, are as follows: March 14-15, 1953, 10 observed (eight collected); March 23, 1954, two collected; March 28, 1954, seven collected; March 5, 1955, two collected. None of these snakes was found in hibernation, and none under cover.

Gregarious hibernation is suggested by Wood (*op. cit.*) on the basis of an annual migratory swim of cottonmouths from the Barrier Beach swamps eastward across upper Back Bay during the fall months. Others report hibernation as a solitary event for this species. None of the specimens observed during early spring months was found in the immediate vicinity of other specimens during the month of March. However, from the end of March through mid-May aggregations of from two to six or eight specimens are frequently encountered in the field. After mid-May the snakes again are rarely found closely associated. The period of spring aggregation is probably related to courtship and the "combat dance" (Carr and Carr, 1942, Proc. New Engl. Zool. Club, 20: 1-6), neither of which has been observed by the authors.

Crotalus horridus atricaudatus Latreille

Most cottonmouths remain so close to water that with few undulations they can retreat into it. On some occasions specimens are found at some distance from surface water, however, as on September 20, 1954, when a young specimen was found 100 yards from the nearest surface water in Gum Swamp.

Although frequently reported by the inhabitants, the canebrake rattlesnake was found only on one occasion (a 6-ft. DOR) by Werler and

McCallion during three years of field observations in Princess Anne County. We can report four other specimens. Two (a female of 66 in. and a male of 72 in. total length) were collected on August 5, 1952, near Lake Drummond. Two weeks after capture the male passed a fecal bolus of raccoon hair. On September 3, 1952, these snakes were observed mating; coition lasted 15 minutes. Several months later the female was dissected and found to contain seven embryos.

On August 14, 1954, two other canebrake rattlesnakes were collected 6 mi. E. Suffolk. One had just emerged from a hole in the ground, and the second was still concealed in a subterranean crevice when discovered. Apparently these specimens were found in their diurnal retreat from the heat, for there was no inactivity to suggest aestivation. On August 27, 1954, the larger bore 13 young whose total length averaged 12 inches; on September 12, 1954, the second bore seven young whose total lengths averaged 14 inches.

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SOUTHERN OCCURRENCE OF THE OLYMPIC SALAMANDER *RHYACOTRITON OLYMPICUS*.—The ambystomid salamander *Rhyacotriton olympicus* Gaige is at present known only west of the crest of the Cascade Mountains from the Olympic Peninsula in Washington to 10.6 miles west of Dyerville (by road to Honeydew), Humboldt County, California (Stebbins and Lowe, Univ. Calif. Publ. Zool., 1951, 50(4): 473). In view of this limited distribution its discovery 75 miles airline farther south is noteworthy.

The tailed frog *Ascaphus truei* Stejneger and the Olympic salamander occupy similar habitats, often frequenting the same streams and occasionally the same niches under stones. Their ranges along the Pacific coast are similar, although there seem to be no published records for *Rhyacotriton* in British Columbia or coastal Washington east and north of the Olympic Peninsula. Recently Salt (Copeia, 1952, 3:194) discovered *Ascaphus* at Russian Gulch State Park, Mendocino County, California, about 70 miles south of its former southernmost locality of reported occurrence near Dyerville, a locality it shares with *Rhyacotriton*. In view of the close association of the two species, it seemed probable that *Rhyacotriton* would in time also be found at Russian Gulch State Park. On March 26, 1955, a brief search was made there for both species without success. The next day, however, at Dark Gulch approximately 6½ miles airline south of Russian Gulch and ¾ mile north of Albion, Mendocino County, California, both species were obtained. Eleven *Rhyacotriton*, 4 of them larvae, and a half grown *Ascaphus* were found beneath moss-covered stones in a seepage on the south slope of the Gulch. The site is

about 150 feet above sea level and approximately 125 yards east-southeast of State Highway 1.

Dark Gulch is a steep-sided canyon occupied by a small stream that flows to the west. At the site of collection the canyon walls slope at an angle of about 45 degrees; the bottom of the canyon is about 80 feet across and consists of a nearly level alluvial deposit through which the stream meanders. At the time of my visit the stream was 6 to 8 feet wide and from a few inches to a foot in depth. There were occasional stretches of cobble with riffly water, interspersed with pools with silt bottoms. The seepage where the *Rhyacotriton* were found was about 2 to 6 feet wide and extended directly down the south slope; the angle of its bed was about 45 degrees. It joined the main stream where the latter flowed against the base of the south slope. There was little indication of the presence of the seep except near its juncture with the stream; it was mostly concealed by moss-covered rocks, branches, and dead leaves. How far the seep extended was not determined. After working up slope for about 40 feet, carefully raking through the water washed angular rocks, coarse sand and silt, its end was not yet in sight.

In the bottom of the gulch, some with their bases buried in the alluvium, were alders in leafless, catkin stage among a herbaceous ground cover of coltsfoot (*Petasites palmata*), salmon-berry (*Rubus spectabilis*), nettle (*Urtica*) and cow parsnip (*Heracleum lanatum*). On the sides of the canyon near the seepage were grass, horsetail (*Equisetum*), red elderberry (*Sambucus racemosa*), and sword fern (*Polystichum munitum*). Trees present were California laurel (*Umbellularia californica*), redwood (*Sequoia sempervirens*), and Douglas fir (*Pseudotsuga taxifolia*), the latter dominant and forming with scattered redwoods a dense forest 50-60 yards up slope from the canyon bottom.

Other animals found in the seepage were 3 giant salamander larvae (*Dicamptodon ensatus* Eschscholtz), each about 3 inches in length, 2 slender salamanders (*Batrachoseps attenuatus* Eschscholtz), earthworms, carabid beetles, isopods, and snails. The *Dicamptodon* were found within the first 10 feet whereas the *Rhyacotriton* appeared about 15 feet up slope from the stream, to a distance of 40 feet where the search ended. It is probable that *Dicamptodon* larvae prey on *Rhyacotriton* and the failure to find the two together reinforces an earlier impression that *Rhyacotriton* may penetrate up small tributaries and seepages in part, at least, to escape the more intense predation present in deeper more open water. A *Dicamptodon* larva was also found in a shallow, rocky portion of the main stream although no intensive search was made there.

Temperature conditions were in accord with previous observations on the thermal environment of *Rhyacotriton*. Two temperatures taken between 11:30 and 11:50 a.m., in the water-saturated gravel of the seep were 9.4°C and 10.0°C. Air temperature ½ inch above the ground (sky overcast) was 10°C at 11:50 a.m.—Robert C. Stebbins, Museum of Vertebrate Zoology, University of California.

ADDITIONAL REMARKS ON ALBINISM IN *MICROHYLA CAROLINENSIS*.—Anderson (1951, *Herpetologica,* 7:56) reported the occurrence of albino tadpoles of *Microhyla carolinensis* in drainage ditches on the Tulane University campus in New Orleans, Louisiana. The writer collected a mature pair of albino *Microhyla* on July 23, 1951, at the same locality, the university housing project at the rear of the Tulane Stadium. Intermittent rains for several days previous to, as well as the afternoon and early evening of the above date, initiated breeding choruses of *Microhyla, Bufo valliceps,* and *Hyla squirella.* Both albino frogs were moving in water when first observed. The female was taken from the same ditch from which Anderson collected his tadpoles, while the male was found in a ditch on the west side of the housing project, some 250 yards distant. The male did not call, although he was observed without disturbance for approximately thirty minutes. No unusual behavior on the part of either individual was noted. Normal colored individuals were observed moving in the ditches at the same time. Efforts to mate the two frogs in the laboratory were not successful. The specimens are deposited in the Tulane Collection (TU 13972).

Continued observations of *Microhyla* eggs, tadpoles and adults during the summer of 1951, and the spring-summer of 1952, 1953, and 1954 revealed no other albinos. The housing project is bordered to the south by the Tulane Stadium, and by residential districts to the north, east and west. The nearest *Microhyla* population (of equivalent size or larger) is that of Audubon Park, approximately one and one-half miles away, separated by city streets and residences. Despite intensive investigation of the Audubon Park population, no albinos have been observed (P. K. Anderson, personal communication).

Since albinism is generally regarded to be recessive, its appearance in any population might be reflective of close inbreeding. Its presence in the campus population would appear to support the hypothesis that little gene flow occurs between this and other populations.

Both *Bufo* and *Microhyla* spend the non-breeding portion of their annual cycle around the foundations and beneath the buildings of the housing project, under favorable conditions coming out on the grass lawns to feed. The survival of the conspicuous albino individuals would appear to be enhanced by this situation.—Robert E. Gordon, Northeast Louisiana State College, Monroe, Louisiana.

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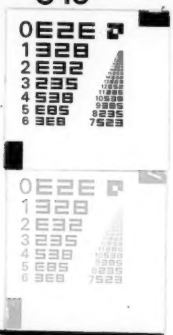
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